Feb. 14, 1933. B. H. ANIBAL 1,897,783

INTERNAL COMBUSTION ENGINE

Filed Jan. 24, 1929 4 Sheets-Sheet 1

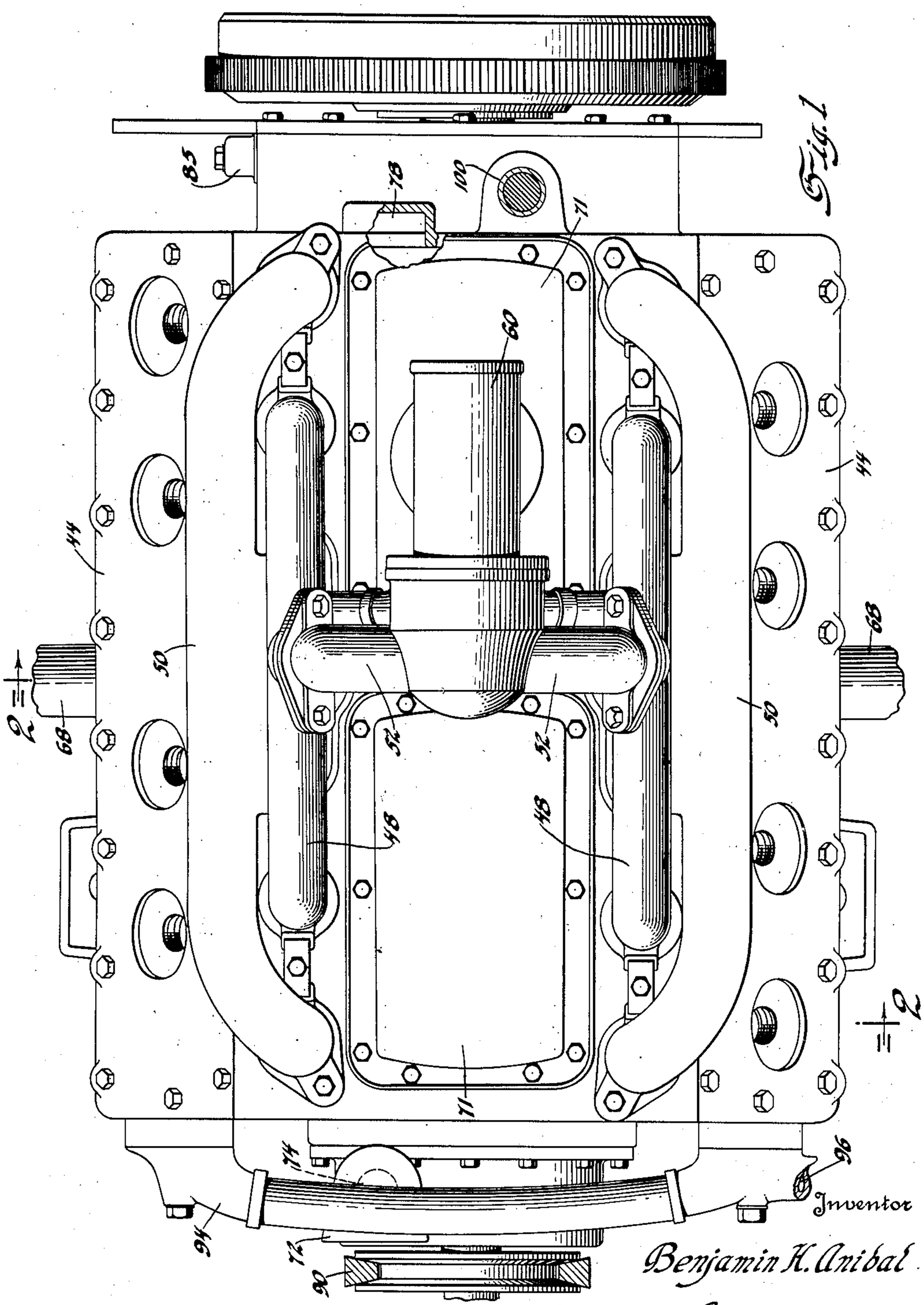

Fig. 1

Fig. 2

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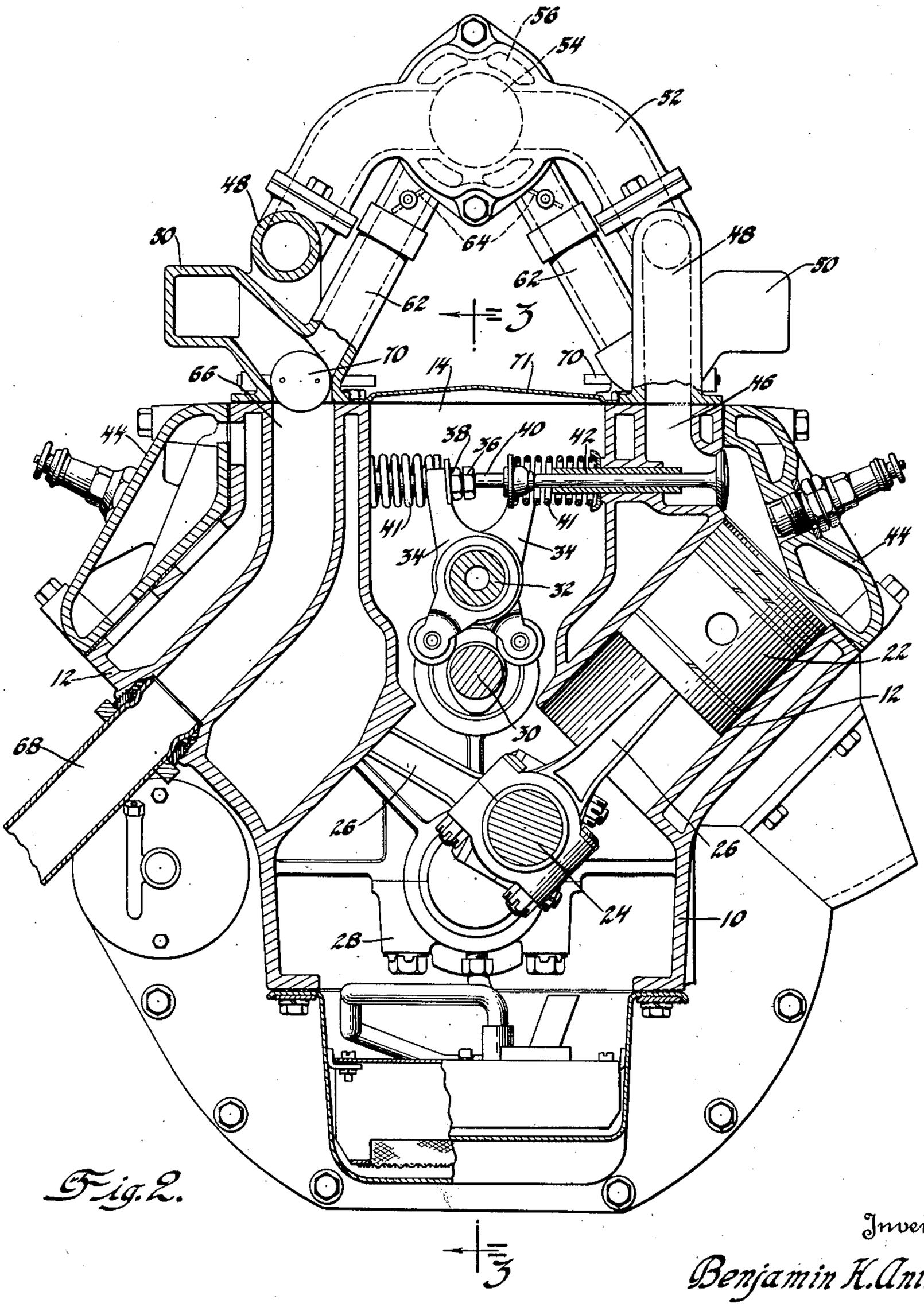

Fig. 2.

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INTERNAL COMBUSTION ENGINE

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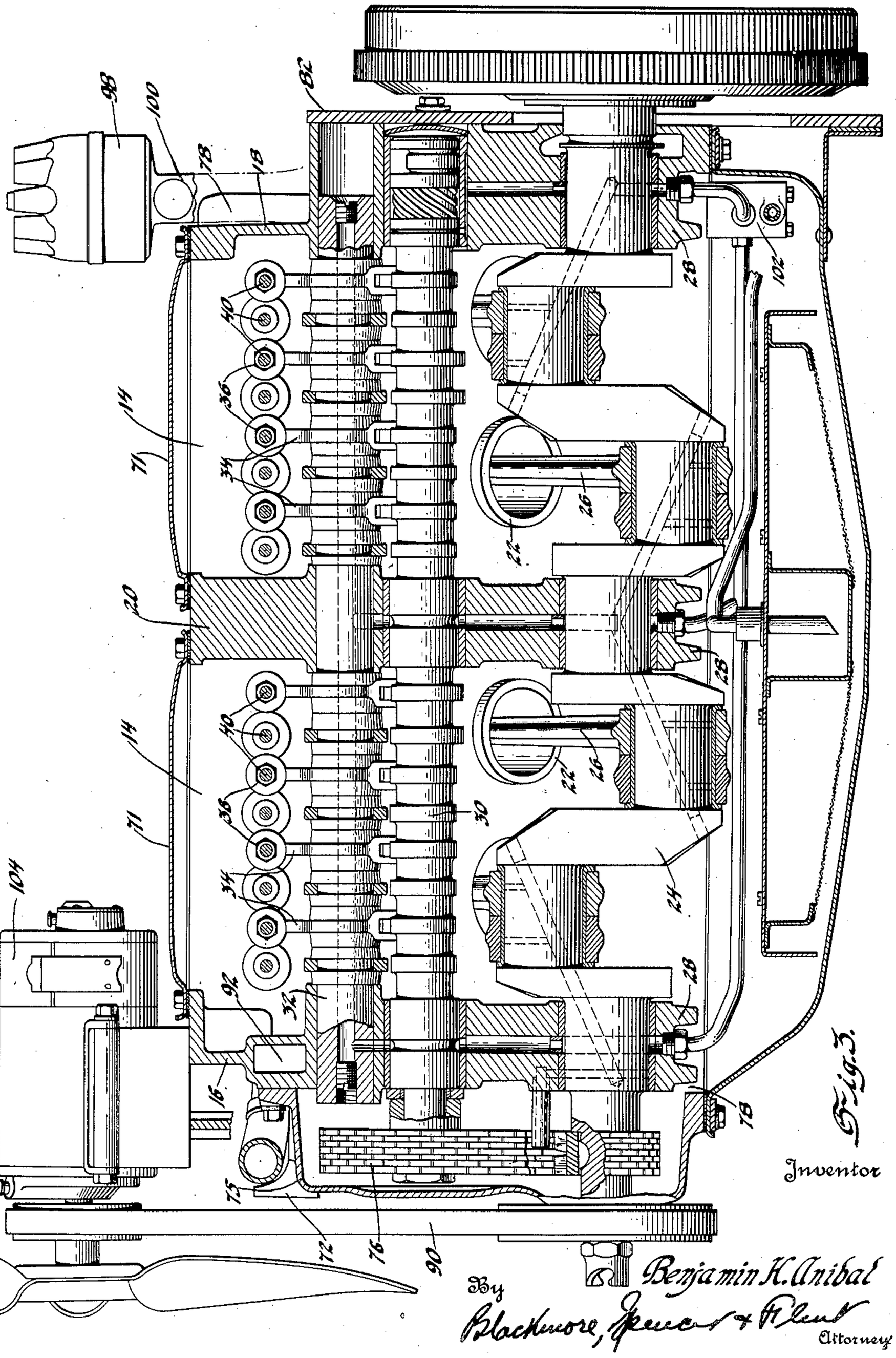

Fig. 3.

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INTERNAL COMBUSTION ENGINE

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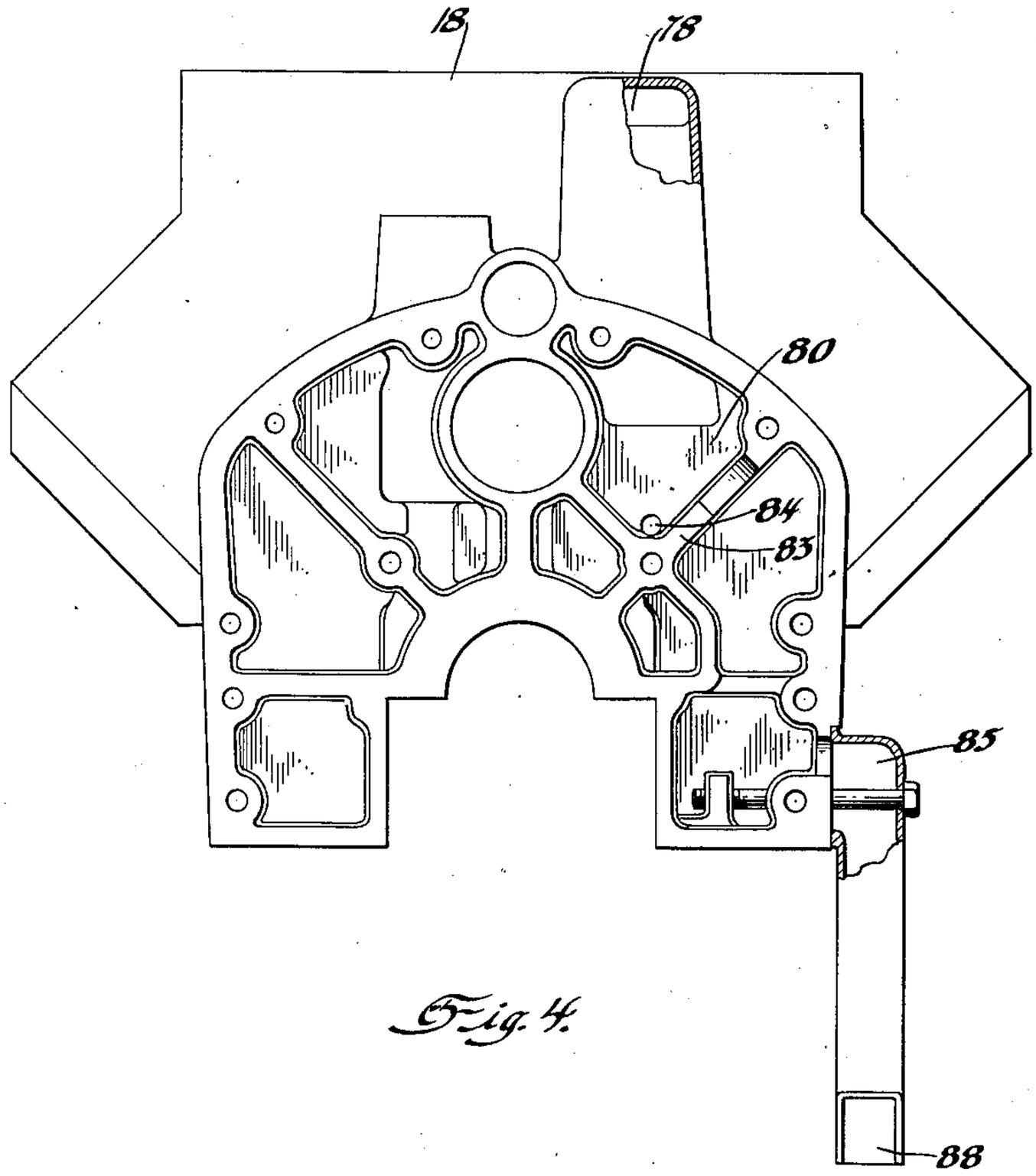

Fig. 4.

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UNITED STATES PATENT OFFICE

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INTERNAL COMBUSTION ENGINE

Application filed January 24, 1929. Serial No. 334,653.

This invention relates to internal combustion engines of the V-type.

One obstacle to the adoption of V-engines in present day automobiles is that the engines heretofore developed have been large and heavy, and have been particularly characterized by great over-all width requiring especially wide hood compartments to house them. The greater width has been necessary to provide sufficient room in the V to accommodate the manifolds and valve gear as conventionally arranged. As a consequence of their apparently unavoidably large dimensions the engines have not been adapted for use in the smaller and lighter weight automobiles.

My improved engine embodies a special arrangement of valve gear and manifolds which enables a reduction in the over-all width of the engine and consequently provides a degree of compactness not heretofore obtainable. My engine is further characterized by the provision of a special form of cylinder head which is removable to permit access to the pistons and valves and at the same time is so designed as to make it possible to employ the most desirable form of combustion chamber. The special cylinder head, in combination with the arrangement of valves and manifolds has the further important advantage that the exhaust valves may be better cooled than in prior constructions.

Specifically my improved engine comprises a block, which may be composed of one or several castings, and includes two banks of cylinders arranged in the form of a V, preferably with an included angle of 90° or more so as to provide ample room for the valve gear and manifolds. The valves are preferably arranged horizontally, extending at a considerable angle to the bores of the cylinders. This arrangement has the advantage of great compactness.

In commercial engines of the V-type it has been customary to extend the manifolds directly across the V. In order to make the valve gear accessible, I have provided upwardly discharging ports which communicate with substantially vertically extending manifolds. The intake manifolds are connected by an intake passage communicating at its center with a carburetor either of the single or twin type. With the described arrangement, the manifolds are out of the way so that the valve operating mechanism between the blocks is readily accessible for adjustment or repair.

With the position of the valves defined by the requirements of compactness and accessibility, the problem of obtaining a desirable form of combustion chamber has been presented. Obviously, if the cylinder head met the block at a right angle as in the case of conventional V-8 engines, the combustion chamber would have too large a volume to be practicable. It has heretofore been proposed to have the head meet the cylinder at an angle. With this arrangement the combustion chamber is necessarily entirely in the block and its design cannot be varied. The most satisfactory type of combustion chamber consequently cannot be obtained. I have solved the problem thus presented by employing a head which meets the block along a dihedral angle. Specifically the head is of wedge shape and the block is notched to receive it. With this arrangement the combustion chamber is entirely within the head and may be given whatever shape is found most desirable. As a matter of fact it is possible with this arrangement to obtain practically a theoretically perfect combustion chamber for the angled relation of the valves and the cylinder bore gives a degree of compactness not obtainable in other types of engines except where the complication of overhead valves is resorted to. When first considered it was feared that the wedge shaped head was impracticable because of possible difficulty in holding the head and block to the desired limits in machining, and that consequently it might be impossible to secure a good seal at the joint. In practice I have found that the design is entirely practical for manufacture by present day production methods and that owing to the wedging action a better joint is obtained than where the joint lies in one plane.

My improved engine also embodies the feature of forming the cylinders, the upper

part of the crankcase, and the valve compartment as a single casting, thereby reducing foundry and machining costs.

Another feature of my invention consists in the crankcase ventilating arrangement whereby air is introduced into the crankcase at one end, carried over valve mechanism thereby assisting in its lubrication, and is discharged at the opposite end, ridding the crankcase of vapors which would effect dilution of the oil.

Referring to the drawings:

Figure 1 is a top plan view of my improved engine.

Figure 2 is a section on line 2—2 of Figure 1.

Figure 3 is a section on line 3—3 of Figure 2.

Figure 4 is a view of the rear of the engine block with the cylinder heads, valve covers and rear cover plate removed.

The engine block is preferably in the form of a one piece casting comprising the portion 10, which constitutes the upper half of the crankcase, the banks of cylinders 12 arranged in the form of a V and preferably at a 90° angle, and the valve compartments 14 occupying the space between the banks of cylinders. The valve compartments are defined by a vertical web 16 connecting the cylinders at the forward end, a web 18 connecting the cylinders at the rear end, and a central web 20. The cylinders are provided with the usual integral water jackets and in them reciprocate the pistons 22 joined to the crankshaft 24 by connecting rods 26. The crankshaft 24 is journaled in bearings formed in the lower ends of the webs 16, 18 and 20. The bearings are preferably provided with removable lower caps 28 as is customary. Journaled in the webs immediately above the crankshaft is the camshaft 30, and above the camshaft is mounted a stationary shaft 32 on which are pivoted the rockers 34 provided with rollers at their lower ends for engaging the cams on the camshaft 30. The upper ends of the rockers 34 carry adjustable studs 36 threaded therein, and locked in place by nuts 38. Any other desired method of adjustable mounting of the studs may be employed. The studs 36 bear against the stems of the valves 40 which are mounted for sliding movement in guides 42 arranged horizontally in a vertically extending water jacketed portion of the cylinder block. Springs 41 hold the valves on their seats. By reference to Figure 2, it will be noted that the engine block meets the cylinder head 44 along a dihedral angle having its apex at the lower side of the valve seat. With this arrangement it will be apparent that but a very small portion of the combustion chamber is in the engine block. Since the combustion chamber is practically entirely in the head 44, it is possible to give it any shape desired. The arrangement of the valves at a considerable angle to the cylinder axes gives great compactness to the combustion chamber. The shape illustrated on the drawing has been found to be very satisfactory in practice.

Referring to Figure 2, it will be noted that the seat of the valve 40 is situated in a vertical face of the block, and the port 46 bends sharply upwardly just beyond the seat and connects with the manifold 48, in this case the intake. The exhaust manifold 50 preferably bears the same relation to an exhaust port, not illustrated, but located in a similar fashion to the port 46, and the exhaust port is equipped with an exhaust valve substantially duplicating the intake valve 40 in its arrangement.

The intake manifolds 48 are connected by a header 52 which is enlarged at its upper portion to provide a conduit 54 connecting with the carburetor 60, which may be of any conventional type. The carburetor is shown as extending horizontally, but if preferred, a down draft carburetor may be used. The conduit 54 is preferably jacketed as at 56, and the jacket is connected to the corresponding exhaust manifolds 50 by means of passages 62 which may, if desired, be controlled by suitable valves 64 which may be either manually adjustable, or automatically adjustable by connection with the throttle valve, or a suitable thermostat.

The described arrangement of combustion chamber, valves, ports, and manifolds has the advantage that there are no abrupt turns to interfere with the flow of gases to and from the combustion chamber. Furthermore, since in the case of the intake passage the flow is always downward from the carburetor and manifold into the chamber, there is no opportunity for fuel to become pocketed on its way to the combustion chamber. The effect of such pocketing in prior designs has been to cause the engine to receive its fuel in gulps causing it to run irregularly.

Another advantage of the described valve arrangement in the case of the exhaust valve consists in the fact that the portion of the valve between the seat and the water jacketed guide 42 is reduced to a minimum. That this is so will be apparent by considering the greater length of the exposed portion of the valve stem if a uniplanar cylinder head joint were employed. In the case of the exhaust valve the upper side of the seat, as shown at the right of Figure 2, must always be adequately cooled, and consequently must be large enough to contain water passages of adequate capacity. The necessary minimum size of this portion of the block constitutes a limiting factor in design which compels the provision of a greater length of exposed valve stem where conventional forms of head are employed.

Centrally of the engine block, and at each

side of the engine I have provided an exhaust passage 66 extending between adjacent cylinders and discharging into exhaust pipe 68 secured thereto in any suitable manner and leading to the usual muffler. I have shown at 70 at each side of the engine, valves which may be manipulated, if desired, to divert the exhaust gases from the cylinders at one side of the V through the bypass constituted by the conduits 62 and jacket 56 and through the corresponding passages 66 and 68 at the other side of the block. By this means increased heating of the intake mixture may be accomplished.

At 71 I have indicated covers for the tops of the valve compartments suitably bolted to the webs 16, 18, 20 and the connecting portions of the cylinder blocks, as shown in Figure 3. By removing these covers, ready access may be obtained to the valve gear for adjusting the same.

I have preferably provided my engine with an improved crankcase ventilating arrangement comprising a funnel 72 at the front of the motor facing the fan blast, and directing air into the crankcase through conduit 74 which may be provided with a suitable air filter to prevent the entrance of dust. Conduit 74 is mounted in the timing gear cover 75, which houses the chain 76 by which the camshaft 30 is driven from the crankshaft 24. The timing gear housing communicates with the crankcase through suitable openings, such as shown at 78. Provision is made at the rear end of the crankcase for the removal of vapors. As clearly shown in Figures 3 and 4 there is cast integrally with the rear web 18, a passage 78 communicating with the rear valve chamber 14 at its upper end, and communicating with a chamber 80 formed between the rear face of the engine block and the cover 82. Within the chamber 80 is provided a baffle 83 which acts to intercept particles of oil and return them to the crankcase through the port 84 formed at the base of the baffle. To the lower end of the chamber 80 is bolted a pipe 85 which extends beneath the engine. The lower end of the pipe is cut away as at 88 so that the rush of air past it, resulting from the motion of the vehicle, will exert suction on the end of the tube and assist in drawing vapors out of the crankcase.

My improved engine is designed for use with a cross-flow radiator, that is, one in which the water flows from one side to the other instead of from top to bottom as in conventional constructions. The water may be circulated by a suitable pump driven if desired from the fan belt 90. The pump discharges the water into the lower portion of the cylinder jacket at one side of the V and through passage 92 is conveyed to the water jacket at the other side of the V. The heated water is discharged from the cylinder heads into manifold 94, which is provided at one side with an extension 96 leading to the opposite side of the radiator. Obviously, other cooling arrangements may be employed if desired.

The engine accessories may be mounted in any preferred manner. I have illustrated diagrammatically the mounting of the distributor 98 on a vertical shaft 100, which is positioned at the rear of the engine and at its lower end may be arranged to drive the oil pump shown at 102. If desired, the generator may be mounted as shown at 104 on the front of the engine block, and be driven from the fan shaft.

The details of the lubricating system have been described and claimed in my prior application, S. N. 309,264, filed September 29, 1928.

While I have preferred to describe my invention as relating to V-type engines, it is to be remembered that a V-engine is simply two engines having their cylinders radially arranged and their pistons connected to a common crankshaft. Consequently practically all of the features of my invention, such as the form of cylinder head and the arrangement of valve gear, crankcase ventilation, and the like are equally applicable to a single cylinder engine, or to a multi-cylinder engine having its cylinders in line. It is likewise obvious that the same features may be employed in the case of radial engines having cylinders of different angular spacing than that shown; and also to cases in which the radiating cylinders are arranged both above and below the axis instead of above only as illustrated. Obviously, also if preferred, the cylinders may be formed separately from the valve seats, water jacketing, etc., as in cases where they are made out of sheet metal. It is also obvious that various features of my invention, such as the valve operating gear, the manifold, and the arrangement of engine accessories may be greatly varied to suit special conditions without sacrificing important advantages to be obtained from the use of other features, such as the special cylinder head, crankcase ventilation, engine block design, and the like.

The nearest prior art known to me is Guy 1,396,744.

I claim:

1. A V-type engine having a plurality of radially arranged cylinders, a valve chamber between the cylinders, valve mechanism in the chamber, a crankcase common to said cylinders and communicating with said chamber, means for admitting air to the forward end of the crankcase, and means for withdrawing vapors from the rear end of said valve chamber.

2. A V-type engine comprising a crankcase and a plurality of radially arranged cylinders, a valve chamber between said cylinders,

valve mechanism in said chamber, said crankcase being provided with a timing gear chamber at its forward end in communication with the crankcase, a cover for said chamber, means for admitting air to the timing gear chamber, and a suction connection communicating with the rear of the valve chamber for withdrawing vapors therefrom.

3. In an engine a sub-assembly comprising an engine block in the form of a one piece casting formed to provide the upper portion of a crankcase and two banks of cylinders arranged in V formation, said casting being provided with an integral extension arising vertically from the inner edges of the banks of cylinders, the tops of the banks of cylinders and the sides of the block extension being each machined to form a single dihedral angle, and cylinder heads having similarly machined faces each clamped in wedging engagement with the top of one bank of cylinders and the adjacent side of the extension of the block.

4. In an engine a sub-assembly comprising an engine block in the form of a one piece casting formed to provide the upper portion of a crankcase and two banks of cylinders arranged in V formation, said casting being provided with an integral extension arising vertically from the inner edges of the banks of cylinders, including end and intermediate webs providing, in combination with the adjacent banks of cylinders, valve compartments, the top of each of the banks of cylinders and the adjacent side of the block extension being machined to form a single dihedral angle, and cylinder heads having similarly machined faces each clamped in wedging engagement with the top of one bank of cylinders and the adjacent side of the extension of the block.

5. A V type engine comprising a cylinder block in the form of a unitary casting shaped to provide the upper part of the engine crankcase, and a plurality of cylinders integrally joined to the crankcase in alined groups, the groups being arranged in V form, integral webs joining the adjacent sides of the groups of cylinders throughout their height, one of said webs being provided at each end of the engine and one between the ends so that the webs and the cylinder walls provide valve compartments and the webs serve as trusses to brace the cylinders and the crankcase against vibration, a crankshaft journalled in the ends of the crankcase and in the intermediate web, and valve mechanism mounted in said valve compartments, said mechanism comprising shafts journalled in said webs, rockers mounted on one of said shafts, cams on the other shaft for actuating the rockers, and valves for the cylinders mounted in the casting and actuated by the rockers.

6. A V type engine comprising a unitary casting shaped to provide the upper part of an engine crankcase and a plurality of cylinders integrally joining the crankcase in alined groups, the groups being arranged in V formation, each of said groups being provided on their adjacent sides with substantially vertical extensions apertured to provide horizontal valve receiving passages and upwardly turned intake and exhaust conduits, the valve seat faces of the extensions meeting the ends of the cylinders along single dihedral angles, heads closing the ends of the cylinders having angular surfaces fitting the angular surfaces of the blocks, integral webs joining the ends of the groups of cylinders defining a valve compartment, valves in the valve passages having their ends projecting into the valve compartment, a shaft journalled in the webs, rockers on the shaft, a camshaft journalled in the webs and arranged to actuate the rockers, a crankshaft in the crankcase and means for driving the camshaft from the crankshaft.

7. An internal combustion engine comprising a block having a cylinder formed therein, a piston in the cylinder, a removable head for the block closing the upper end of the cylinder, said head having its underside machined all over to form two plane surfaces meeting each other at an angle, and the top of said block having its upper end machined all over to provide two plane surfaces meeting each other at the same angle, bolts securing the head to the block and operating when drawn up to cause the surfaces of the head to slide over the surfaces of the block and wedge said head into place in the angle in the block.

8. An internal combustion engine comprising a block having a cylinder formed therein, a piston in the cylinder, a removable head for the block closing the upper end of the cylinder, said head having its underside machined all over to form two plane surfaces meeting each other at an angle, and the top of said block having its upper end machined all over to provide two plane surfaces meeting each other at the same angle, said head being formed to provide a combustion chamber at the angle between said surfaces, and one of said surfaces having a portion overlying the cylinder bore, bolts securing the head to the casting and operating when drawn up to cause the surfaces of the head to slide over the surfaces of the block and wedge said head into place in the angle in the block.

9. An internal combustion engine comprising a block having a cylinder formed therein, a piston in the cylinder, a removable head for the block closing the upper end of the cylinder, said head having its underside machined all over to form two plane surfaces meeting each other at an angle, and the top of said block having its upper end machined all over to provide two plane surfaces meeting each other at the same angle, said head being

formed to provide a combustion chamber at the angle between said surfaces, and one of said surfaces having a portion overlying the cylinder bore, bolts securing the head to the casting and operating when drawn up to cause the surfaces of the head to slide over the surfaces of the block and wedge said head into place in the angle in the block, a gasket separating the peripheral portions of the surfaces of the head and block, said gasket spacing the overlying portion of the cylinder head from the top of the piston to provide additional combustion chamber space.

10. An internal combustion engine comprising a plurality of radially arranged blocks having cylinders therein, pistons in the cylinders, each of said cylinders terminating at a surface lying substantially at right angles to the axis of the bore and in a single plane, each of said blocks being provided with a substantially vertical surface extending upwardly from the upper edge of the first named surface, said vertically extending surfaces being provided with intake and exhaust ports, substantially horizontally extending valves cooperating with said ports and lying within the angle defined by the axes of the cylinders, means within said angle for operating the valves, and removable heads for the blocks machined all over on the underside thereof to provide complementary surfaces for cooperation with the said vertically extending surfaces and the right angularly extending surfaces, said heads being recessed to provide passages connecting the cylinders and ports, and means for clamping said heads to the block operating to cause the surfaces of the heads to slide over the surfaces on the block and wedge the heads into place in the angles of the block.

11. A cylinder block for V-type engines in the form of a unitary casting shaped to provide the upper part of the engine crankcase, integral banks of cylinders joining the crankcase, the banks being arranged in V form, and integral webs joining the adjacent sides of the groups of cylinders, one of said webs being provided at each end of the engine so that the webs and the cylinder walls provide a valve compartment and the webs serve as trusses to brace the cylinders and the crankcase against vibration, a camshaft journalled in said webs, a shaft mounted in said webs above said camshaft, rockers pivoted on said last named shaft arranged to be actuated by said camshaft, and valve mechanism operated by said rockers.

12. A cylinder block for V-type engines in the form of a unitary casting shaped to provide the upper part of the engine crankcase, integral banks of cylinders joining the crankcase, the banks being arranged in V form, and integral webs joining the adjacent sides of the groups of cylinders, one of said webs being provided at each end of the engine so that the webs and the cylinder walls provide a valve compartment and the webs serve as trusses to brace the cylinders and the crankcase against vibration, a camshaft journalled in said webs, a shaft mounted in said webs above said camshaft, rockers pivoted on said last named shaft arranged to be actuated by said camshaft, and valve mechanism operated by said rockers, a removable cover secured to the top of said block extending between said banks of cylinders and covering said valve compartment.

13. A V-type engine comprising a cylinder block in the form of a unitary casting shaped to provide the upper part of the engine crankcase, and a plurality of cylinders integrally joined to the crankcase in alined groups, the groups being arranged in V form, integral webs joining the adjacent sides of the groups of cylinders, one of said webs being provided at each end of the engine and one between the ends so that the webs and the cylinder walls provide valve compartments and the webs serve as trusses to brace the cylinders and the crankcase against vibration, a crankshaft journalled in the ends of the crankcase and in the intermediate web, and valve mechanism mounted in said valve compartments, said mechanism comprising shafts journalled in said webs, rockers mounted on one of said shafts, and cams on the other shaft for actuating the rockers.

In testimony whereof I affix my signature.

BENJAMIN H. ANIBAL.