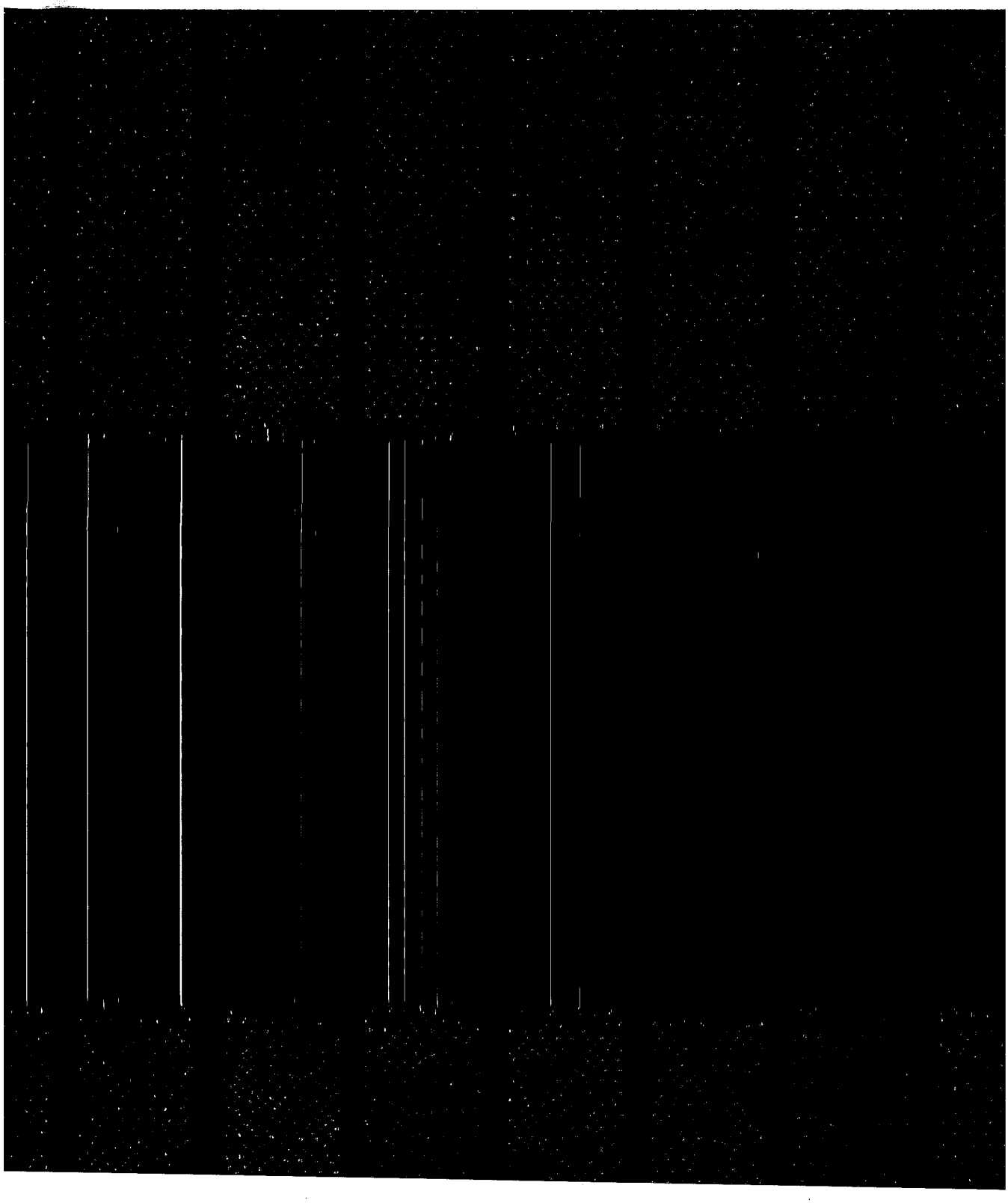


S. I. FEKETE.

INTERNAL COMBUSTION ENGINE.

APPLICATION FILED DEC. 27, 1918.

1,330,436.

Patented Feb. 10, 1920.

2 SHEETS—SHEET 1.



S. I. FEKETE.

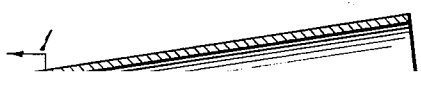
INTERNAL COMBUSTION ENGINE.

APPLICATION FILED DEC. 27, 1918.

1,330,436.

Patented Feb. 10, 1920.

2 SHEETS—SHEET 2.



UNITED STATES PATENT OFFICE.

STEPHEN I. FEKETE, OF DETROIT, MICHIGAN, ASSIGNOR TO ESSEX MOTORS, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

INTERNAL-COMBUSTION ENGINE.

1,330,436. Specification of Letters Patent. Patented Feb. 10, 1920.

Application filed December 27, 1918. Serial No. 268,465.

To all whom it may concern:

Be it known that I, STEPHEN I. FEKETE, a subject of the King of Hungary, residing at Detroit, county of Wayne, State of Michigan, have invented a certain new and useful Improvement in Internal-Combustion Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to improvements in internal combustion engines and particularly to water cooled engines having a thermo-siphon cooling system. The engine embodying my invention has exhaust valves in pockets adjacent the cylinders and inlet valves inverted in the removable cylinder heads and located directly over the respective cylinders. My invention therefore has for its object to provide a water jacketing for an engine having the said arrangement of working elements which shall cool all the parts uniformly and which will induce a sufficient and steady uniform flow through the various cooling spaces.

As is well known to those skilled in the art one difficulty with cooling systems which operate on the thermo-siphon system has been that the water in the system will boil and then steam will accumulate in some portion of the system until a pressure is produced sufficient to overcome the resistance of the flow of the water after which the steam and water will be ejected forcibly. This results in an uneven flow through the cooling system, imperfect and insufficient cooling of certain parts of the engine producing pre-ignition and boiling so that there is a loss of water in the cooling system.

I overcome these difficulties in the engine embodying my invention by directing the cooling fluid first onto the cooler parts of the engine and leading it from them to the hotter parts and placing the parts through which the cooling fluid finally passes into the outlet manifold directly over the hottest parts of the cylinder block casting so that the cooling fluid when heated to its maximum temperature rises and escapes immediately into the outlet manifold.

As is well known to those skilled in the art the space above the exhaust valve is the point of highest temperature in the system, therefore I place the outlets to the outlet manifold directly over the exhaust valves and lead the cooling fluid around the cylinder spark plugs and inlet valves before it passes over the exhaust valves. In this way the cooling fluid flows directly through the water jackets without being turned back on itself in such a manner as to produce eddies or pockets. Furthermore, there is no opportunity for steam to be pocketed and accumulate over the exhaust valve and thus to eject the water forcibly and spasmodically.

In the accompanying drawings, I have shown my invention as applied to a four-cylinder engine having a removable cylinder head, the remainder of the engine being cast in a single block. It will be understood however that my invention is applicable to other types of engines.

The invention will be fully understood from the following description when taken in connection with the accompanying drawings and the novel features thereof will be pointed out and clearly defined in the claims at the close of this specification.

In the drawings, Figure 1 is a transverse section of the cylinder block and removable head and outlet manifold of an engine embodying my invention taken on line 1—1 of Fig. 2.

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

Fig. 3 is a plan view partly broken away.

Referring now to the drawings, at A is shown the cylinder block, at B the removable head and at C the water outlet manifold. The water inlet pipe is shown at D. The cylinders are designated 10, 11, 12 and 13 respectively and each has a combustion chamber all of which are designated 14 in the drawings. The upper surface of the combustion chamber is formed by the under surface of the removable head B. In each combustion chamber 14 is an exhaust valve 15 of the ordinary puppet type. Each combustion chamber communicates through an exhaust passage 16 in the casting with the exhaust manifold 17. The exhaust passages 16 are conveniently of oblong cross section as seen in Fig. 2. Over each cylinder is located an inlet valve 18 which is in inverted position and seats on the under surface of the removable head. The inlet manifold 20 branches and runs longitudinally through the removable head forming circular spaces 21 around each inlet valve 18. The portion 4 of the inlet passage 20 slopes downwardly so that the explosive mixture

of gasolene and air is never anywhere raised thereby improving the volumetric efficiency of the engine.

The spark plugs are designated 23 and are located directly over the respective cylinders. The inlet valve is operated by a rocker arm 24, spring 25, push rod 26, the rocker arm 24 being mounted on a bracket 27 secured to the upper surface of the cylinder head. Such of these parts as are above the upper surface of the removable cylinder head are inclosed in a casing 28. The water outlet manifold C is provided with branches 29 each of which is as nearly directly over the corresponding exhaust valve 15 as the casing 28 permits it to be placed.

The arrangement of water holes connecting the water jacket of the engine block with the space within the removable cylinder head is very important and will now be described.

Since the arrangement on each side of the transverse center line is substantially symmetrical, the location of the holes on one side only will be described. There are two holes 30 and 31 adjacent the cylinder 10 and two more holes 32 and 33 adjacent the cylinder 11. These holes are located between the cylinder and the side wall of the casting and register with corresponding holes in the engine block or removable head as the case may be. At 34 is shown a water hole located in the space between the two cylinders 10 and 11. There is another water hole 35 in a corresponding position on the other side of the cylinder 11. At 36, 37 and 38 are three more water holes located at the sides of the cylinders 10 and 11. There are also larger holes 40, 41, 42 and 43 located between the exhaust valves 14 and the side wall of the cylinder. A small hole 44 is also located between the holes 40 and 41 and another small hole 45 between the holes 42 and 43.

The sizes of the various holes are determined by the amount of cooling fluid which it is desired to have pass the different points, and the total area of the holes connecting the engine block, and water jacket with the water space in the removable head is substantially equal to, though slightly greater than, the area of the outlet manifold or the total area of the branch outlet manifold pipes 29.

At 46 is shown a tube which is inserted in the water jacket of the cylinder block between the two cylinders 11 and 12 for the purpose of directing the flow of water as it enters from the inlet pipe D. This pipe 46 is conveniently made of the shape shown in cross section in Fig. 2 and has a split or opening 47 along the top to permit the escape of a portion of the water which enters through the pipe. This pipe has the effect of distributing the flow of water in the cylinder jacket in a direction such that it improves the circulation in the jacket.

The relative sizes of the various water holes which afford accumulation between the water jacket in the cylinder block and that in the removable head are very carefully proportioned so that the flow of water shall be distributed about the various parts of the engine as is necessary to produce satisfactory cooling and the most rapid circulation possible.

In general water follows the following path: It enters through the inlet pipe D and is distributed lengthwise through the engine block cylinder casting. A portion of the fluid passes around the exhaust valves 15 and the exhaust passages 16 and up through the holes 37, 40 and 41 into the tubular connections 29 of the water outlet manifold C. Another portion of the water rises on the side of the cylinders which is away from the exhaust valves and escapes through the holes 30, 31, 32, 33, 34 and 35 into the jacket in the removable head. Being at this time on the side of the engine away from the exhaust valves the water in escaping through the tubular connections 29 must flow around the inlet valves 18 and across that portion *a* (see Fig. 1) of the wall of the removable head which lies directly over the valve pockets 14 and the exhaust valves 15. Since these are the hottest points in the engine the water on reaching these points is suddenly heated and tends to rise sharply thereby stimulating the flow of cooling fluid through the system. While the tubular connections 29 of the outlet manifold C are not directly over the exhaust valves 15 when viewed in the plane of Fig. 1, they are nevertheless substantially so and therefore there is no tendency for steam, if steam should be formed by the passage of the water over the valve pockets, to be pocketed and to produce spasmodic flow in the cooling system. While the outlet manifold is placed as nearly over the exhaust valves when viewed in Fig. 1 as is permitted by the valve operating mechanism, the position to the left of the center line of the exhaust valves 15 is an advantage rather than a detriment because this position forces the cooling fluid to traverse the surface of the valve pockets before it escapes through the tubular connections 29 of the water outlet manifold. I find in actual practice that the herein-described cooling system is much more efficient than thermo-siphon systems heretofore in use, and that a rapid flow of water properly proportioned to the relative temperatures of the respective parts of the engine results and that there is no pocketing of the cooling fluid which results in spasmodic flow even when the engine is run very hot.

What I claim is:

1. In an internal combustion engine hav-

ing a thermo-siphon cooling system, an engine block having valve pockets at one side of each cylinder, a water outlet manifold, and exhaust valves in said pockets, the said water outlet manifold being substantially over the said exhaust valves so that the most highly heated cooling fluid will rise directly into the said outlet manifold.

2. In an internal combustion engine having a thermo-siphon cooling system, an engine block having a plurality of cylinders and a valve pocket for each cylinder formed therein, exhaust valves in said pockets, a water outlet manifold having a separate tubular connection for each of said cylinders, said tubular connections being substantially over the respective exhaust valves, so that the most highly heated cooling fluid will rise directly into the corresponding tubular connections of the outlet manifold.

3. In an internal combustion engine, cylinders, exhaust valves at the sides of the cylinders, a water outlet manifold above and to one side of said exhaust valves, there being water holes at the sides of the cylinders away from the exhaust valves so that the water which comes up through said water holes may pass across said exhaust valves to escape through said outlet manifold.

4. In an internal combustion engine, an engine block containing a plurality of cylinders arranged lengthwise of the block, an exhaust valve for each cylinder each located in a pocket on the same side of the cylinders, an inverted inlet valve above each cylinder, valve actuating mechanism for said inlet valves located above the said cylinders, and an outlet manifold above the exhaust valves and beside the said inlet valve actuating mechanism, there being water holes at the side of the cylinders away from the exhaust valves so that the cooling fluid which passes up through said water holes must pass across the wall of the valve pocket opposite the exhaust valve to escape through the outlet manifold.

5. In an internal combustion engine, an engine block containing a plurality of cylinders arranged lengthwise of the block, an exhaust valve for each cylinder each located in a pocket on the side of the cylinder, a removable head for the cylinder block, inverted inlet valves in said head, and an outlet manifold above said exhaust valves and having as many openings as there are exhaust valves, there being registering water holes in the proximate faces of said cylinder block and removable head some of said holes being located on the side of the cylinders which is away from the exhaust pockets so that the water passing through said holes must pass across the wall of the removable head over the valve pocket before it escapes through the outlet manifold.

6. In an internal combustion engine, an engine block containing a plurality of cylinders and having exhaust pockets and exhaust passages passing out of the block on the same side as the exhaust pockets, an exhaust valve for said cylinders in said pockets, a water jacket about the cylinder, exhaust pockets and exhaust passages, a removable head for the cylinder block, inverted inlet valves in said head, an outlet manifold on said head above the exhaust valves, there being registering water holes in the proximate faces of said cylinder block and removable head some of said holes being located on the side of the cylinders which is away from the exhaust pockets so that the water passing through said holes must pass across the wall over the valve pocket before it escapes through the outlet manifold, and others of said holes providing direct communication between the portion of the jacket about the exhaust valves and the water space in the removable head below the outlet manifold.

7. In an internal combustion engine having a thermo-siphon cooling system, an engine block having a plurality of cylinders and a valve pocket for each cylinder therein, exhaust valves in said pockets, a removable head for said cylinder block, inverted inlet valves in said head over said cylinders, and an outlet manifold substantially over the exhaust valves, there being water holes at the side of the cylinders away from the exhaust valves so that the cooling fluid which comes up from the side of the cylinders through said water holes must pass across the wall of the removable head over the valve pocket before it escapes through the outlet manifold.

In testimony whereof I affix my signature.

STEPHEN I. FEKETE.