

Feb. 26, 1946.

H. SCHRECK

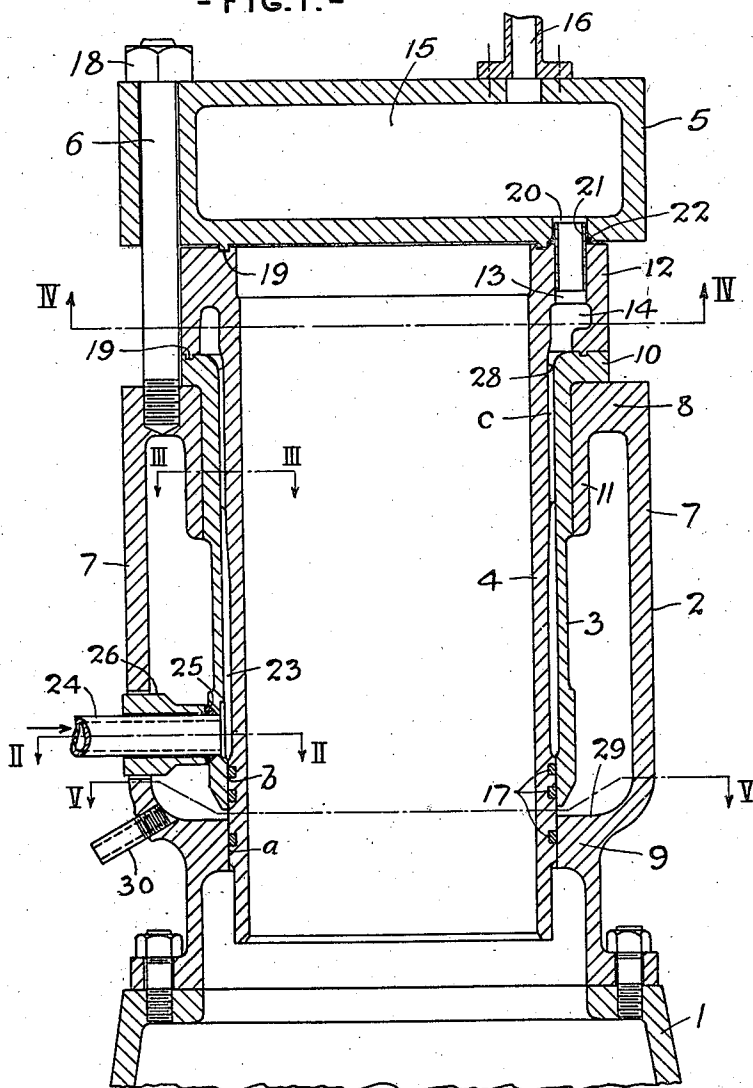
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INTERNAL-COMBUSTION ENGINE

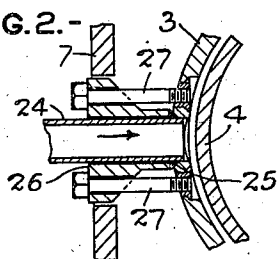
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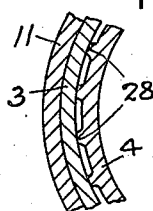
- FIG. 1.-



- FIG. 2.-



- FIG. 3.-



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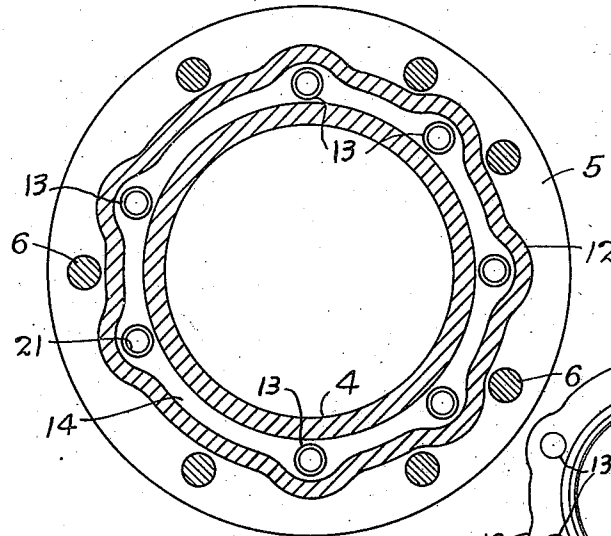
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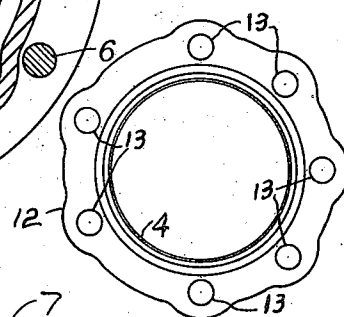
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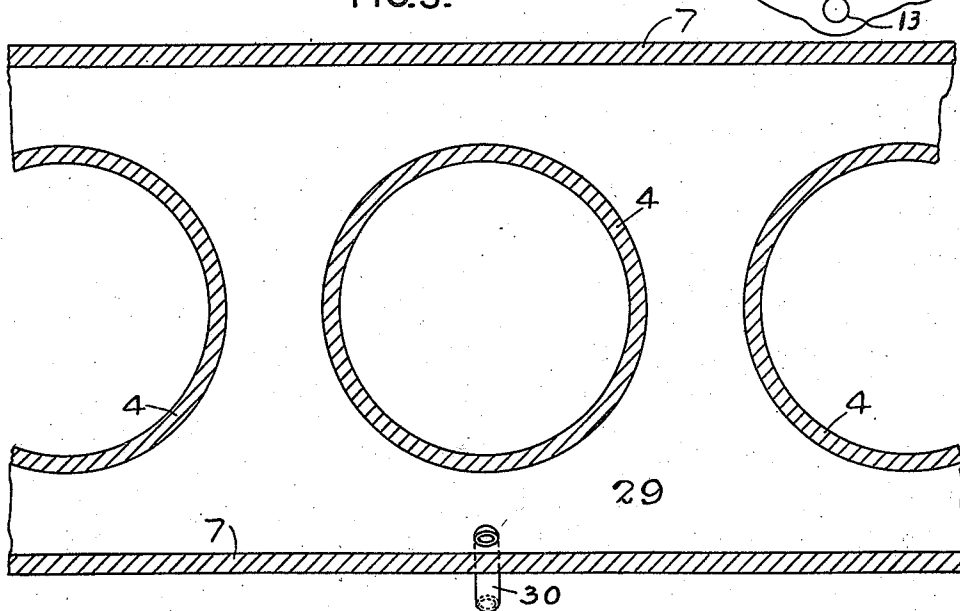
- FIG. 4.-



- FIG. 6.-



- FIG. 5.-



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INTERNAL-COMBUSTION ENGINE

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6 Claims. (Cl. 123—173)

This invention relates to internal combustion engines.

A principal object of the present invention is to prevent cylinder jacket water from escaping into the crank case.

A further object is to maintain, in an engine of the aforesaid characteristics, the usual feature of eliminating any injurious tension of the cylinder liner during the power stroke.

A further object is to reduce the weight of the cylinder jacket cooling water to a minimum.

A further object is to provide optimum cooling of the piston and piston rings of the engine by high velocity flow of cooling water through the space between the cylinder liner and jacket.

A further object is to provide a separate cylinder liner and jacket which can be manufactured by simple casting as well as by welding procedures.

Other and further objects of this invention will appear from the following description, the accompanying drawings and the appended claims.

Referring to the drawings forming a part of this application, Figure 1 is a vertical central sectional view of the engine, parts being shown in full, and parts being broken away; Fig. 2 is a fragmentary section on the line II—II of Fig. 1, parts being shown in full; Fig. 3 is a fragmentary section on the line III—III of Fig. 1; Fig. 4 is a section on the line IV—IV of Fig. 1 showing parts of a single cylinder of the engine; Fig. 5 is a fragmentary section on the line V—V of Fig. 1; and Fig. 6 is a plan view, on a reduced scale, of the cylinder liner.

The invention is adaptable to a single cylinder internal combustion engine but as it will, in ordinary practice, be employed in a multiple cylinder engine, such an engine is shown. Nevertheless its adaptability to an engine of either one or more cylinders will be readily apparent. In a multi-cylinder engine, as the cylinders and their associated parts are similar in so far as the present invention is concerned, only one such assemblage will be described.

Referring more particularly to Fig. 1, here is shown, more or less diagrammatically, a cylinder and its associated parts, but only such parts as are necessary for a full understanding of the invention. The engine comprises a crank case 1, a hollow cylinder block 2, a jacket 3, a cylinder liner 4, a cylinder head 5, and securing studs 6. The block is bolted to the crank case and is open thereto. The crank case is conventional as is also the block in the main. Therefore they are only shown fragmentally.

The block has side walls 7, a top transverse wall 8, and spaced therefrom another transverse wall 9. The walls 8 and 9 are provided with aligned orifices respectively for the jacket and liner and the side walls 7 are spaced from the orifices and indicated in Fig. 5 as straight, parallel walls adapted for a plurality of cylinders, according to usual practice.

The jacket 3 is provided with a top flange 10 seating on the wall 8. The jacket extends from its flange floatingly into the block through and in engagement with the adjacent orifice of wall 8 and a sleeve 11 extending from the wall at the orifice. The liner 4 likewise has a top flange 12 seating on the jacket 3, preferably at its flange 10, as shown, the flange 12 having a circular row of orifices 13 opening through its top face and opening at their bottoms to a circular chamber 14 provided in the flange 12.

The head 5 is hollow, providing a chamber 15 open to a pipe 16 connected thereto. The liner 4 floatingly extends from its flange through the jacket and therebeyond through the aligned orifice in the wall 9 in sliding engagement therewith, and likewise in sliding engagement with the lower end of the jacket. These sliding fits of the liner with the wall 9 and jacket 3, indicated respectively at *a* and *b*, are rendered water-tight by sealing rings 17, preferably made of rubber or rubber composition.

The flanges 10 and 12 are tightly clamped between the wall 8 and head 5 by a circular row of the securing studs 6 which are screwed into the wall 8, pass therefrom upwardly through orifices in the head 5 and have screwed thereon, at their extended ends, clamping nuts 18. The head is thus directly secured to the block 2 free from the flanges 10 and 12.

The jacket and liner, due to their floating characteristics, are free to expand and contract under temperature changes. The liner, being free from bolt or other rigid connection to the block at its lower end, is not subjected to any tension during the power stroke, this tension being transmitted to the block by the studs 6. The flanges 10 and 12 and the flange 12 and head 5 are provided at their respective jointures with circular tongue and groove connections 19.

The head 5 is provided with a circular row of orifices 20 registering respectively with the orifices 13. The registering orifices are provided with a thimble 21 extending across the joint between the flange 12 and head 5, and at this joint the orifice 20 is provided at its lower end adjacent the orifice 13 with a groove or counter-

sink containing packing 22 which is compressed when the nuts 18 are screwed home, thereby sealing the joint between the flange 12, head 5 and thimble 21, providing a detachable slightly flexible joint.

A separate cylinder head is shown for the liner 4, but it will be understood that in a multi-cylinder engine a single head may be employed covering all the liners. To save space in disposing the studs 6 and thimbles 21, the side face of the flange 12 and likewise that of the flange 10 are scalloped as shown in Fig. 4.

A space 23 for flow of cooling liquid, such as water, is provided between the jacket and liner and extends from the fit b to and communicating with the chamber 14. A pipe 24, opening into this space, passes through a countersunk orifice in the jacket near its lower end and is held in sealed engagement therewith by packing 25 compressed in the countersunk orifice by a gland 26 passing freely through an orifice in the block 2 and secured to the jacket by bolts 27.

The space 23 is preferably constricted near the outlet end thereof, and while the flow may be in either direction, it is indicated by arrows as entering the pipe 24 which then serves as the inlet, passing upwardly through the space 23 into the head 5 and therefrom through the pipe 16 which then serves as the outlet. Therefore the constricted portion of the space is at the upper end, being indicated at c. This portion is circumferentially divided by spaced vertical ribs 28 formed integral with the liner.

It will be seen from the foregoing that the block, jacket, liner and cylinder head are all connected together by the studs 6, the jacket and liner being merely clamped at their flanges between the block and head by the studs. As thus connected each of the four parts, namely the block, jacket, liner and head, are free for separate removal, one from the other, by merely removing the nuts 18 from the studs 6. They are thus each separate parts and the most suitable metal can therefore be chosen for each.

The block, which is separated by the jacket from the circulating cooling water, is preferably made of steel which would easily become objectionably corroded if it formed a wall for the circulating liquid. The sides of the block may be provided with numerous openings (not shown) to reduce its weight. The jacket and liner, which are in contact with the flowing liquid, are preferably made of cast iron which is more resistant to corrosion than steel. Cast iron is suitable for the jacket and liner on account of their floating characteristics, as aforesaid, they thereby being subjected to no objectionable tension strains during running of the engine, as for instance during the power stroke.

The jacket and liner, each being made separately, can each be cast in one piece or each formed in several pieces welded together, by any simple well-known casting and welding procedure. Casting the liner and jacket separately instead of in one piece enables a narrower cooling water space and a narrower constricted portion thereof to be provided than could otherwise be the case. This reduces the weight of the cylinder jacket cooling water to a minimum, and due to its high velocity, provides optimum cooling of the piston and piston rings of the engine.

While the fit b is sealed by the rings 17, nevertheless it has a sliding fit subject to temperature changes, and the flowing liquid, which is under pressure, may, at times, escape through

this fit, and would enter the crank case, as in ordinary practice, unless precautionary measures are taken in constructing the engine to prevent this. To meet this condition, in the present invention the wall 9 is provided separating the fit b from the crank case, and is sealed to the liner by one or more of the rings 17, only one ring being shown at this fit a as it is deemed all that is necessary to prevent escaped liquid, which has lost its pressure, after passing through the fit b, from passing through the fit a to the crank case. The wall 9 has an upper flat face 29 preferably spaced slightly below the lower end of the jacket 3 which catches the liquid escaping through the fit b, and a drain pipe 30 extending through the wall of the block adjacent this face is provided for draining off any liquid that collects on the face.

While there has been hereinbefore described an approved embodiment of this invention, it will be understood that many and various changes and modifications in form, arrangement of parts and details of construction thereof, may be made without departing from the spirit of the invention, and that all such changes and modifications as fall within the scope of the appended claims are contemplated as a part of this invention.

The invention claimed and desired to be secured by Letters Patent is:

1. An internal combustion engine comprising a crank case; a hollow cylinder block open at its lower end to said case; a jacket in said block; a cylinder liner in said jacket providing therewith a space therebetween having an inlet and an outlet for flow of a cooling liquid under pressure therethrough, said liner, at a portion thereof below said jacket, having a liquid-tight sliding fit with said block at a portion thereof having an upper transverse face below said jacket, sealing said block above said face from said case, and said liner further having above said face and adjacent said space a substantially liquid-tight sliding fit with said jacket, whereby cooling liquid escaping through said liner-jacket fit will be stopped by said face from entering said case through said liner-block fit, said block at its upper end having an orificed transverse wall embracing said jacket at said orifice, said jacket having a flange supported on said wall and said liner having a flange supported on said jacket whereby said jacket and liner are floating suspended respectively from their said flanges; a cylinder head supported on said liner; and means directly securing said block and head together with said flanges clamped therebetween.

2. An internal combustion engine comprising a crank case; a hollow cylinder block open at its lower end to said case; a jacket in said block; a cylinder liner in said jacket providing therewith a space therebetween, said liner, at a portion thereof below said jacket, having a liquid-tight fit with said block at a portion thereof having an upper transverse face below said jacket, sealing said block above said face from said case, and said liner further having above said face and adjacent said space a substantially liquid-tight fit with said jacket, whereby cooling liquid escaping through said liner-jacket fit will be stopped by said face from entering said case through said liner-block fit, said jacket having a flange supported on said block and said liner having a flange supported on said jacket; a chambered cylinder head supported on said liner, said liner flange and said head having aligned orifices affording communication between said space and

said chamber; and a thimble in said aligned orifices, said space and said chamber being provided each with a port, one serving as an inlet and the other as an outlet for flow of a cooling liquid under pressure through said space and chamber.

3. An internal combustion engine comprising a cylinder block; a cylinder head at one end of said block; a crank case secured to the other end of said block; a cylinder cooling liquid jacket disposed in said block; and a cylinder liner disposed in said jacket, a part of the outer face of said liner being spaced from a part of the inner face of said jacket providing a cylinder cooling liquid space, said liner, jacket, head and block being separate members immovably connected together adjacent said head, said liner and jacket being floatingly suspended from their said immovable connection, said liner having sliding liquid-tight engagement with said block beyond said jacket and said jacket at its end remote from its said immovable connection having sliding liquid-tight engagement with said liner.

4. An internal combustion engine comprising a hollow cylinder block; a liner in said block; and a jacket in said block surrounding said liner, said liner and jacket at corresponding ends being rigidly connected to said block at a corresponding end thereof and free at their opposite ends for axial movement relative to said block and to each other, said liner opposite one end being laterally supported by said block in sealed axially sliding relation therewith, and said jacket being laterally supported by said liner in sealed axially sliding relation therewith, said jacket having a portion of its length spaced from said liner providing a passage for flow of a cooling liquid, said passage having an inlet and an outlet.

5. An internal combustion engine comprising a crank case; a hollow cylinder block connected at one end to said crank case and provided with an interior cylindrical wall adjacent said end providing an orifice; a separate jacket in said block; a separate cylinder liner in said jacket; and a separate cylinder head at the opposite end of said block, said block at its said opposite end

and said jacket and liner at their respective ends adjacent said block opposite end, and said head, being detachably rigidly secured together, said jacket extending from its said end toward but terminating short of said cylindrical wall in floating relation at its opposite end with said block, and said liner extending from its said end toward said crank case and through said cylindrical wall orifice in floating relation at its opposite end with said block and with said jacket, said jacket at its said opposite end, and said liner adjacent said jacket opposite end having a liquid-tight sliding fit with each other, said jacket beyond said sliding fit being spaced from said liner providing a passage having an inlet and an outlet for a cooling liquid, said liner having a liquid-tight sliding fit with said cylindrical wall preventing any liquid which escapes through said jacket-liner fit from reaching said crank case, and said block having a vent to the exterior at the side of said cylindrical wall remote from said crank case for discharging said escaped liquid.

6. An internal combustion engine comprising a cylinder block; a cylinder head at one end of said block; a crank case secured to the other end of said block; a cylinder cooling liquid jacket disposed in said block; a cylinder liner for a piston disposed in said jacket, a part of the outer face of said liner being spaced from a part of the inner face of said jacket providing a cylinder cooling liquid space, said liner, jacket, head and block being separate members immovably connected together adjacent said head, said liner and jacket being floatingly suspended from their said immovable connection, said liner having sliding liquid-tight engagement with said block beyond said jacket and said jacket at its end remote from its said immovable connection having sliding liquid-tight engagement with said liner; and a row of spaced ribs in said space increasing the velocity of said cooling liquid therein, said ribs extending longitudinally of said liner and from said liner outer face part to said jacket inner face part, said ribs being disposed to transmit side thrusts of said piston to said jacket.

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