Nov. 18, 1930. F. H. ROYCE ET AL 1,782,317

CYLINDER OF INTERNAL COMBUSTION ENGINES

Filed Dec. 7, 1927

Fig 1

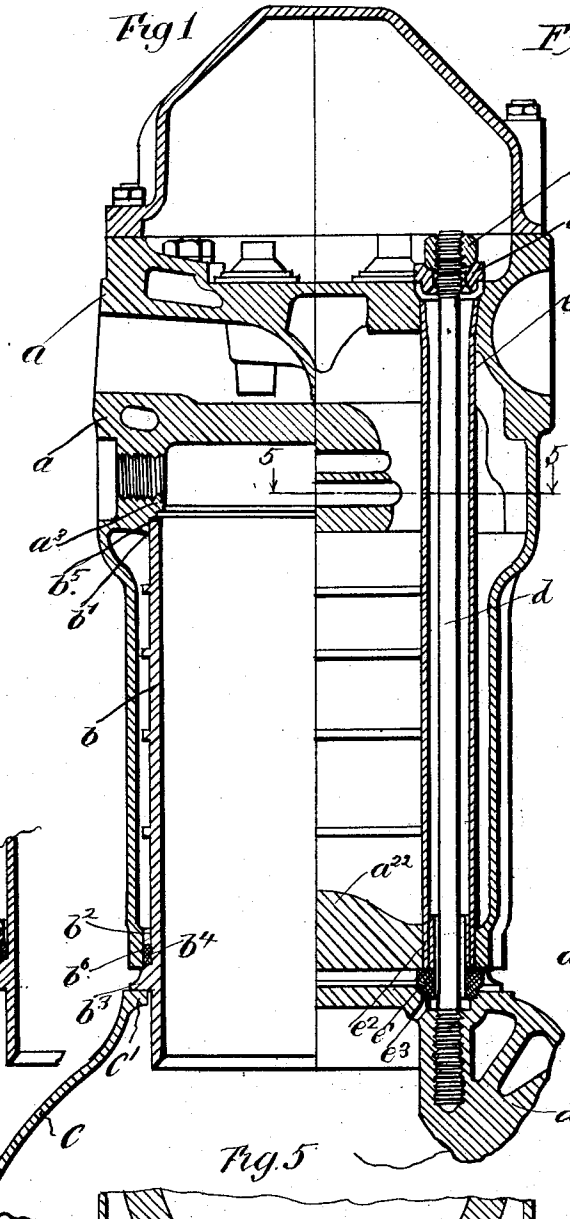


Fig.2

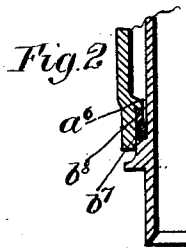


Fig.4.

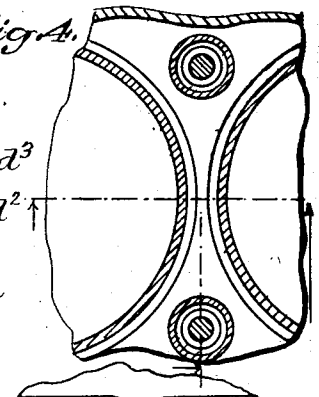


Fig.3

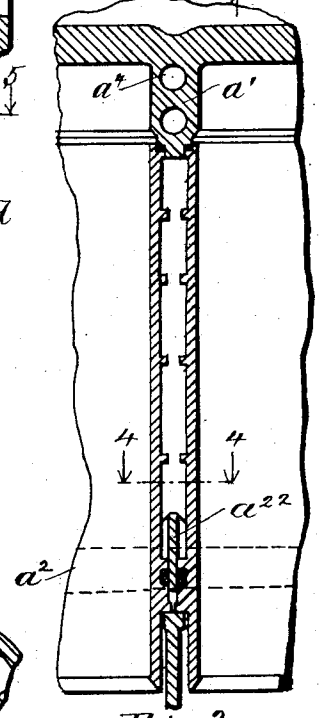
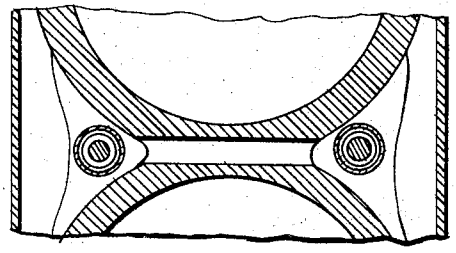


Fig.5



Inventors.
Frederick Henry Royce
Arthur John Rowledge
Albert George Elliott
by Connolly Bros
Attys

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UNITED STATES PATENT OFFICE

FREDERICK HENRY ROYCE, OF WEST WITTERING, NEAR CHICHESTER, AND ARTHUR JOHN ROWLEDGE, OF ELLERSLIE, DERBY, AND ALBERT GEORGE ELLIOTT, OF WEST WITTERING, NEAR CHICHESTER, ENGLAND

CYLINDER OF INTERNAL-COMBUSTION ENGINE

Application filed December 7, 1927, Serial No. 238,442, and in Great Britain December 24, 1926.

This invention has reference to internal combustion engines of the type in which the cylinder block comprising the outer walls of the water jacket, the cylinder heads, the valve chambers, the valve guides, and the walls of the cooling water spaces around the heads and bends, is made of aluminium or aluminium alloy. The cylinder barrels (in this type of engine) are of steel or other suitable metal in the form of liners supported in the aluminium cylinder block and the cooling water is in direct contact with the cylinder barrels.

Hitherto it has been the general practice in constructing engines of the type referred to, to make the cylinder heads, valve chambers, valve guides and the walls of the water cooling spaces around the heads and valve chambers of one casting, and the remaining part of the block of another casting, to insert the cylinder barrels at the "upper" ends of the latter casting, and locate them therein axially by means of outwardly projecting flanges on the cylinder barrels at the "upper" ends thereof, seating respectively on annular bosses on the said latter casting and held in position by the former casting which is subsequently attached. Such arrangement has drawbacks, and in particular it is difficult with such an arrangement to make a water-tight joint between the aluminium block and the cylinder barrel at the base of the block (i. e. at the lower end of the water jacket), and in case of leakage through such joint to prevent the water from finding its way into the crank shaft chamber.

This invention is an improved construction of the type of engine in which the aluminium cylinder block comprising the outer walls of the cylinder jacket, cylinder heads, valve chambers, valve guides and water jacket of the heads is in one casting and the cylinder barrels are inserted through circular holes formed in the casting.

The invention consists mainly in the method of fixing an aluminium cylinder block to a crank shaft case and further in making secure water and gas tight joints at the "head" end and water tight joints at the "base" end of the cylinder barrels.

According to this invention the aluminium cylinder block is fixed to the crank shaft case by long studs screwed into the latter, passing through holes in the base of the aluminium cylinder block and extending through the water space of the cylinder jacket to and through the upper part of the block and secured by nuts on the upper side thereof.

In the accompanying drawings is illustrated an example of this invention, the cylinder barrel being of steel.

The left hand half of Fig. 1 is a section on the axis of one cylinder across the cylinder block and the right hand half between two adjacent cylinders as shown in Fig. 4. Fig. 2 is a part-section showing the alternative method of making a water joint at the base of the cylinder. Fig. 3 is a part-sectional elevation between two adjacent cylinders (on a plane at right angles to the sections in Fig. 1), and Fig. 4 is a plan section on line 4—4 of Figure 3, and Fig. 5 a plan section on line 5—5 of Fig. 1.

a is the aluminium casting comprising the outer wall of the cylinder water jacket, the heads, valve chambers, valve guides, and the water cooling jacket of the valve chambers and valve guides. The casting is formed with circular recesses to constitute the heads of the cylinders converging and coalescing as shown at a^1, and the base a^2 (shown in broken lines in Fig. 3) is formed with a strengthening web a^{22} extending between adjacent cylinders. The casting is further formed with shoulders a^3 to act as seatings for the steel cylinder barrels, a^4 are holes to admit cooling water. b are steel cylinder barrels formed with shoulders b^1 which seat against the shoulders a^3 with copper asbestos washers b^5 intervening thus making a gas and water tight joint. The cylinder barrels are formed with thickened out parts b^2 terminating in flat surface flanges b^3 which seat on the orifices of the crank shaft case. Annular recesses b^4 are formed in the walls of the cylinder barrels, preferably with the base of the recess curved inwards and annular rubber blocks b^6 are located in these recesses thus forming a water tight joint. Referring to Figure 2 which illustrates another form

of water tight joint a^6 are flanges of internal diameter sufficient to allow the flange b^1 to pass through, b^7 is a rubber washer and b^8 a springy split ring in cross section shape of an L. Referring to Fig. 1, c is the crank shaft case formed with a flange c^1 around each opening to constitute a seating for the flange b^3 of the steel cylinder. d are studs, threaded at each end, screwed into holes formed in bosses d^1 on the crank shaft case, d^2 are dogs or bridge pieces with a perforation through the centre for the stud d to pass through and with each end seating on a boss formed on the casting, d^3 are nuts screwed on the bolts whereby the said aluminium casting is firmly secured to the crank shaft case, e are aluminium tubes encircling the bolts d for the purpose of protecting them from the cooling water, expanded out at each end to make water tight joints in holes in the base and in the top of the aluminium cylinder block. The tubes e also act an oil drains whereby oil from the valve mechanism is conducted through the holes e^3 into the crank shaft case. e^1 are annular oil resisting rubber blocks inserted in recesses in the bosses around the bolts against which the tubes e impinge. e^2 are tapered tubes closely fitting in the tubes e and extending into and closely fitting the annular rubber blocks e^1, for the purpose of making a water and oil tight joint between the tubes and the crank shaft case.

What we claim is:—

1. In a multi-cylinder internal combustion water-cooled engine, a cylinder block having a single walled cooling jacket, and head and base portions all integrally cast of aluminum alloy, said head and base portions being recessed and having packing means associated therewith for seating steel cylinder liners therein, registering bolt holes formed in said head and base portions, fastening means passing through said bolt holes and connecting with a supporting crank-case, and aluminum tubes having gas and water-tight connections with said head and base portions surrounding said fastening means.

2. In an internal combustion water-cooled engine, according to claim 1, means for making oil tight joints between the tubes and the crank-case, comprising annular recesses in the boss of the crank-case around the fastening means, the latter consisting of threaded bolts, annular oil-resisting rubber blocks in said recesses with a clearance between the same and the bolts, the ends of the aluminum tubes impinging on the outer faces of the rubber blocks, and short tapered tubes encircling the bolts with a clearance therefrom inserted in and closely fitting the annular blocks.

In witness whereof we have signed this specification.

FREDERICK HENRY ROYCE.
ALBERT GEORGE ELLIOTT.
ARTHUR JOHN ROWLEDGE.