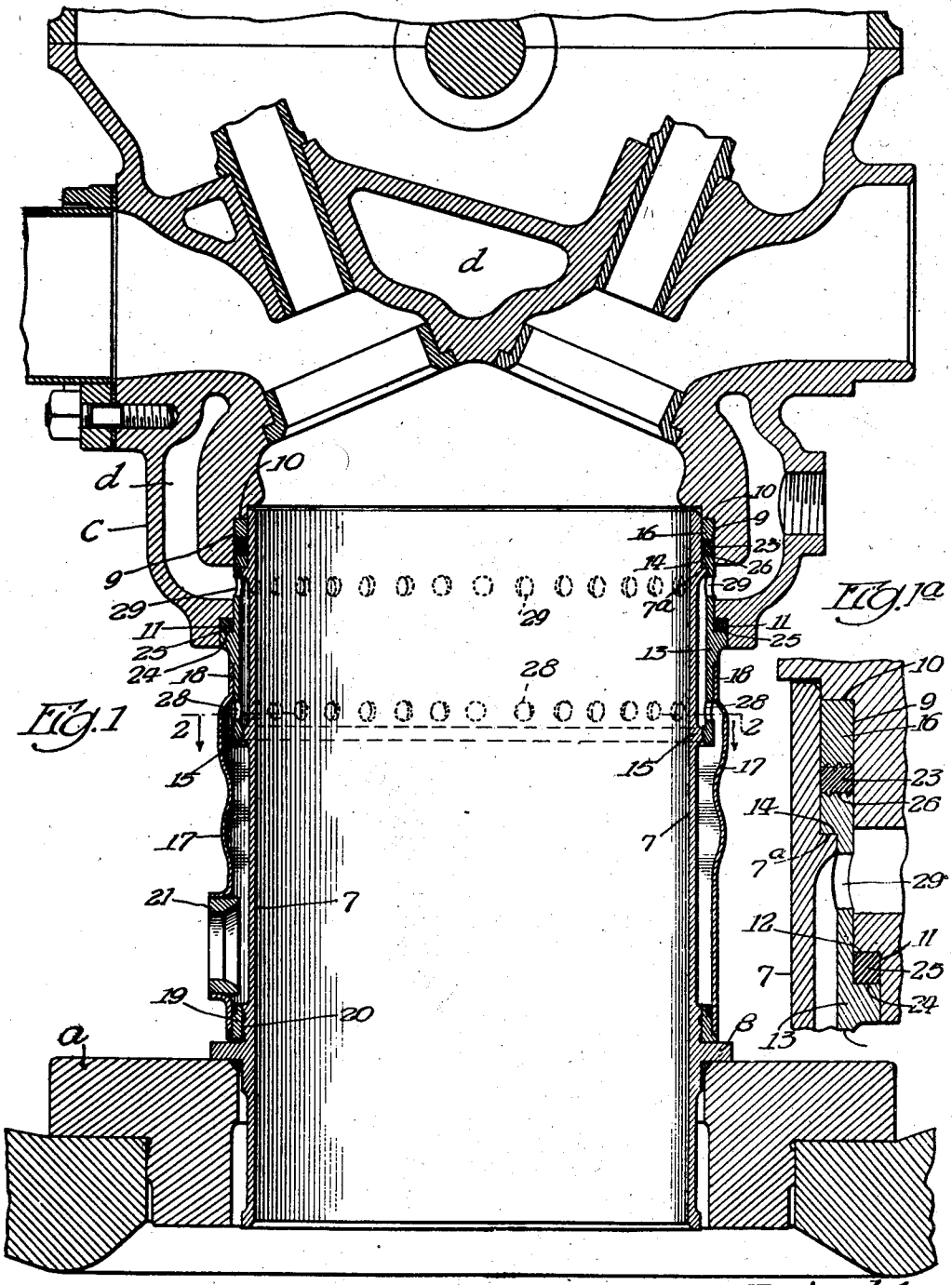
Dec. 3, 1946. B. S. KRATZER 2,411,924

CYLINDER STRUCTURE FOR ENGINES

Filed Jan. 19, 1945 2 Sheets-Sheet 1



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Fig. 2

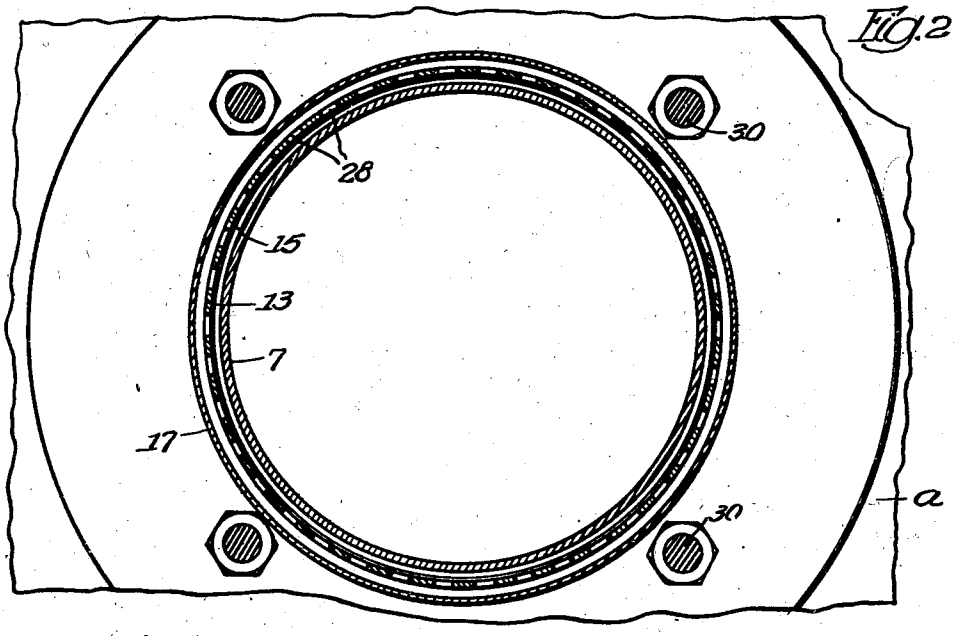


Fig. 4

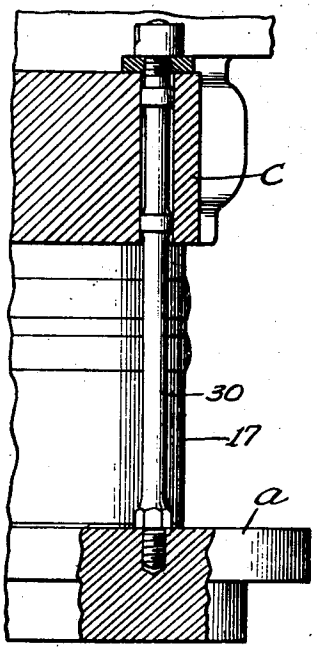
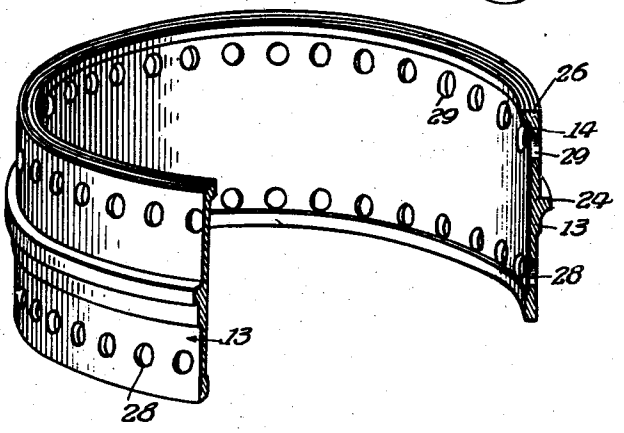


Fig. 3



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CYLINDER STRUCTURE FOR ENGINES

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9 Claims. (Cl. 123—173)

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The invention relates to cooled cylinder structures and cylinder-heads for internal combustion engines.

One object of the invention is to provide a cooled cylinder-structure and head which are adapted, when assembled together, to provide seals between the head and the cylinder-structure for preventing the escape of combustion gasses, and for preventing the escape of coolant between the cylinder-jacket and the sealing-head.

Another object of the invention is to provide a pre-assembled cylinder-structure which comprises a sleeve and a coolant-jacket which can be readily fabricated as a unit and assembled with the cooled cylinder-head and the engine-casing.

Other objects of the invention will appear from the detailed description.

The invention consists in the several features hereinafter set forth and more particularly defined by claims at the conclusion hereof.

In the drawings:

Fig. 1 is a longitudinal section of a cylinder-structure and cylinder-head embodying the invention.

Fig. 1—*a* is a section on an enlarged scale of a portion of the cylinder-head, sleeve and cylinder-barrel and the seals.

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

Fig. 3 is a sectional perspective of the coolant transfer-sleeve, through which the coolant flows between the cylinder-head and the water-jacket around the barrel.

Fig. 4 is a section illustrating one of the bolts for securing the cylinder-head on the engine-casing with the cylinder-structure therebetween.

The invention is exemplified in an internal combustion engine wich comprises a crank-case *a*, a cylinder-structure, and a cylinder-head *c*. The usual inlet-valve for fuel and the exhaust-valve for combustion gasses are mounted in the cylinder-head and the latter is provided with a chamber *d* through which coolant flows for cooling the head, as well understood in the art. The cylinder-structure comprises a barrel, a coolant-transfer sleeve between the barrel and the head, and a coolant jacket around the barrel, which are adapted to be pre-assembled in the engine into a unitary structure for convenient installation.

The cylinder-head is formed with a bore or internal annular groove 9 which terminates in an annular shoulder 10 and with a second bore or internal annular groove 11 which terminates

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in an annular shoulder 12. A ring 16, preferably of hardened steel, is shrunk in the outer end of bore 9 and against shoulder 10 in the cylinder-head.

The cylinder for the usual piston consists of a barrel 7, the outer end of which is extended into the cylinder-head and provided with an external annular shoulder 7—*a* and at its inner end with a shoulder 8, which is adapted to seat on the engine-casing or crank-case *a*. A coolant-transfer sleeve or jacket section 13 is preferably formed of hard steel, provided with an internal annular shoulder 14 which abuts the annular shoulder 7—*a* on the outer periphery and adjacent the upper end of barrel 7, and the outer periphery of the sleeve fits in the bore 9 of the cylinder-head. Sleeve 13 is also provided with an annular shoulder 24 which fits in the bore 11 of the cylinder-head. Sleeve 13 is shrunk around the barrel 7 with its shoulder 14 in abutting relation with shoulder 7—*a* on the barrel 7. The barrel 7 is also formed with a rib 15 of a prepared diameter and the lower end of sleeve 13 is shrunk around said rib. An expansible coolant jacket 17 has its upper end silver-soldered or brazed, as at 18, to the outer periphery of sleeve 13. A ring 19 is silver-soldered or brazed to the inner periphery of the lower end of the jacket 17 and is shrunk-fit to the outer periphery of a rib 20 formed on the barrel. A fitting 21 for a coolant-connection is suitably secured in the jacket 17. Sleeve 13 is provided at its inner end with an annular series of ports 28 for the flow of coolant from the jacket into the sleeve and with an annular series of ports 29 for conducting coolant from the sleeve to the chamber *d* in the cylinder-head, so that the coolant from fitting 21 will flow through the jacket 17 and sleeve 13 to cooling-chamber *d* in the cylinder-head *c*. Chamber *d* is connected to an outlet connection for the coolant, as well understood in the art. A ring 23, preferably of soft metal, is confined in the bore 9 of the cylinder-head and is compressed between ring 16 and sleeve 13 to form a seal for preventing the escape of gasses from the cylinder, between the barrel and the cylinder-head. The faces of sleeve 13 and ring 16 which engage the sealing ring 23 are provided with grooves 26 to form a biting engagement with the metal of ring 23. A ring or gasket 25 of suitable elastic material is confined in the bore 11 of the cylinder-head and compressed between a shoulder 12 in the cylinder-head and shoulder 24 on sleeve 13 to form a seal for preventing

escape of coolant between the jacket and the cylinder-head.

The cylinder assembly is clamped by bolts 30 between the cylinder-head and the crank-case. Said bolts are adapted to draw the cylinder-head toward the crank-case and to compress the sealing ring 23 in the bore 9 of the cylinder-head and between ring 16 and the upper end of sleeve 13 and to also compress the elastic ring 25 in the bore 11 of the cylinder-head between shoulder 12 and annular shoulder 24 on sleeve 13.

The bolts are sufficiently elastic to insure a nearly constant compression pressure on the cylinder-barrel and the seals, regardless of the varying loads imposed thereon by the combustion process and thermal changes occuring in the structure.

In fabricating, the cylinder-head, bores 9 and 11 and shoulders 10 and 12 can be readily machined therein. The ring 16 is shrunk into the bore 9 and against shoulder 10. In fabricating the barrel, its periphery, shoulder 8, ribs 15 and 20 can be readily machined thereon. The sleeve 13 and its shoulders 14 and 24 can be readily machined for a shrink-fit on the barrel. The ring 19 with its inner periphery machined for a shrink-fit on rib 20 is secured in the inner end of sleeve 17 and its outer end is secured to the sleeve 13. The assembled sleeve 13, jacket 17 and ring 19 are assembled with the barrel by shrinking the sleeve 13 and ring 19 on the barrel. The barrel-sleeve and jacket will then form a unitary structure which is adapted to be replaceably installed between the crank-case and the cylinder-head. When the head c is secured against the cylinder structure by bolts 30, the head and cylinder structure will be replaceably installed on the engine.

In operation, the coolant will flow through fitting 20 around the barrel 7 and jacket 17, ducts 28, sleeve 13 and ducts 29 to the cooling chamber *d* in the cylinder-head. The sealing ring 23 will prevent the escape of gases from the cylinder between the head and the cylinder, and the sealing-ring 23 will prevent the leakage of the coolant between the sleeve 13 and the cylinder head.

The invention exemplifies a cylinder-head and cylinder structure with sealing means between them for preventing the escape of gases between the cylinder and the head and the escape of coolant between the jacket and the head.

The invention also exemplifies a structure which comprises a cylinder and jacket which are adapted to be economically fabricated into a unitary structure for installation and removal from the engine.

The invention is not to be understood as limited to the details described, since these may be modified within the scope of the appending claims without departing from the spirit and scope of the invention.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent is:

1. An engine comprising: a cylinder-head provided with a pair of bores with internal annular shoulders; a ring seated in one of said bores; a cylinder structure including a barrel extending into said head and a sleeve for coolant around the barrel, having a portion fitting in one of the bores and shoulders fitting in the other of said bores; sealing means between the sleeve and the ring in the head for preventing the escape of gases between the cylinder and the head, and sealing means in said other bore between the external shoulder on the sleeve and the shoulder in said last named bore, for preventing the escape of coolant between the jacket and the head.

2. A cylinder structure for engines comprising: a cylinder barrel provided with an external annular shoulder; a sleeve for coolant shrunk on the barrel and provided with an internal shoulder abutting the shoulder on the barrel, an external annular shoulder and coolant ports; and a coolant jacket having its outer end joined to the sleeve and its inner end joined to the barrel.

3. A cylinder structure for engines comprising: a cylinder barrel provided with an external annular shoulder; a sleeve for coolant shrunk on the barrel and provided with an internal shoulder abutting the shoulder on the barrel, an external annular shoulder and coolant ports; a coolant jacket having its outer end joined to the sleeve; and a ring inside of and secured to the inner end of the jacket and shrunk on the barrel.

4. An engine comprising: a cylinder head provided with a pair of bores with internal annular shoulders and a ring seated in one of the bores; a cylinder structure including a barrel extending into said head and a sleeve for coolant around the barrel, having a portion fitting in one of the bores and shoulders fitting in the other of said bores; sealing means in one of the bores between the sleeve and the ring, for preventing the escape of gases between the cylinder and the head, sealing means in the other bore between the external shoulder on the sleeve and the shoulder in said last named bore for preventing the escape of coolant between the jacket and the head; a coolant jacket between the sleeve and the inner end of the barrel, and means for securing the cylinder structure in the head with the sealing means compressed.

5. An engine comprising: a cylinder-head provided with a coolant chamber and a pair of bores with internal shoulders; a cylinder barrel extending into the head; a sleeve secured around the cylinder barrel provided with coolant ducts, communicating with the coolant chamber in the head; means in one of the bores forming a seal between the head and the sleeve for preventing the escape of gases between the barrel and the head; means in the other bore, between the sleeve and the head, forming a seal for preventing the escape of coolant between the head and the sleeve; and a jacket between the sleeve and the inner end of the barrel, the sleeve having ports communicating with the space between the barrel and the jacket and means for securing the barrel and sleeve in the head and compressing both of the sealing means.

6. An engine comprising: a cylinder-head provided with a coolant chamber; a cylinder barrel having its outer end extending into the head; a separately formed sleeve fitting around and fixed to and defining an annular coolant chamber around the outer end portion of the barrel; an expansible jacket secured to the inner end of the sleeve and defining an annular chamber around the inner portion of the barrel and provided with a coolant connection; the sleeve being provided with ports communicatively connecting the annular chamber between the sleeve and the barrel with the annular chamber formed by the jacket and with the coolant chamber in the head; sealing means for preventing the escape of gases between the barrel and the head; and sealing means for preventing the escape of coolant between the sleeve and the head.

7. An engine comprising: a cylinder-head provided with a coolant chamber and a pair of bores with internal annular shoulders; a cylinder-barrel having its outer end extending into the head; a separately formed sleeve fitting around and fixed to and defining an annular coolant chamber around the outer end portion of the barrel, and provided with external annular shoulders fitting in the bores, respectively; a jacket secured to the inner end of the sleeve and defining an annular chamber around the inner portion of the barrel; the sleeve being provided with ports communicatively connecting the annular chamber between the sleeve and the barrel with the annular chamber formed by the jacket and with the coolant chamber in the head; sealing means in one of the bores between one of the annular external shoulders on the sleeve and one of the internal shoulders in the head, for preventing the escape of gases between the barrel and the head; and sealing means in the other bore between the other external shoulder on the sleeve and the other internal shoulder in the head, for preventing the escape of coolant between the sleeve and the head.

8. An engine comprising: a cylinder-head provided with a coolant chamber and a pair of bores with internal annular shoulders; a cylinder barrel having its outer end extending into the head; a separately formed sleeve fitting around and fixed to and defining an annular coolant chamber around the outer end portion of the barrel and provided with an annular shoulder at its outer end, and an external annular shoulder fitting in the bores, respectively; a jacket secured to the inner end of the sleeve and defining an annular chamber around the inner portion of the barrel; the sleeve being provided with ports communicatively connecting the annular chamber between the sleeve and the barrel with the annular chamber formed by the jacket and with the coolant chamber in the head; sealing means between the shoulder on the outer end of the sleeve and one of the internal shoulders in the head, for preventing the escape of gases between the barrel and the head; and sealing means between the other shoulder on the sleeve and the other internal shoulder in the head, for preventing the escape of coolant between the sleeve and the head.

9. An engine comprising: a cylinder-head provided with a coolant chamber and a pair of bores with internal annular shoulders; a cylinder-barrel having its outer end extending into the head and provided with an annular external shoulder; a separately formed sleeve fitting around and fixed to and defining an annular coolant chamber around the outer end portion of the barrel and provided with external annular shoulders fitting in the bore, respectively, and an annular internal shoulder abutting the annular shoulder on the barrel; a jacket secured to the inner end of the sleeve and defining an annular chamber around the inner portion of the barrel; the sleeve being provided with ports communicatively connecting the annular chamber between the sleeve and the barrel with the annular chamber formed by the jacket and with the coolant chamber in the head; sealing means in one of the bores between one of the annular external shoulders on the sleeve and one of the internal shoulders in the head, for preventing the escape of gases between the barrel and the head; and sealing means in the other bore between the other external shoulder on the sleeve and the other internal shoulder in the head, for preventing the escape of coolant between the sleeve and the head.

BLAIR S. KRATZER.