June 6, 1967 G. F. GROSSHANS ETAL 3,323,503

PISTONS COMPRISING AN INNER COOLING CIRCUIT

Filed Oct. 18, 1966 2 Sheets-Sheet 1

Fig. 1.

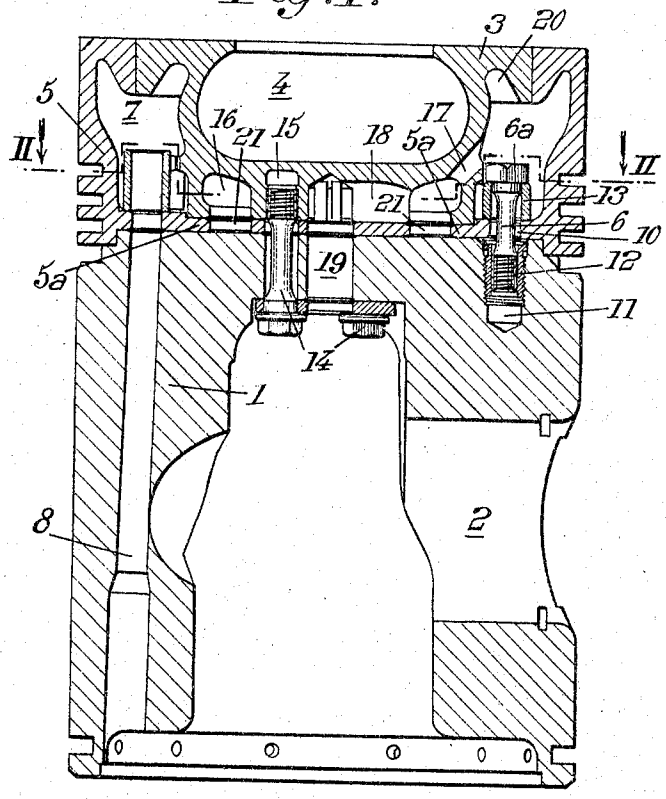
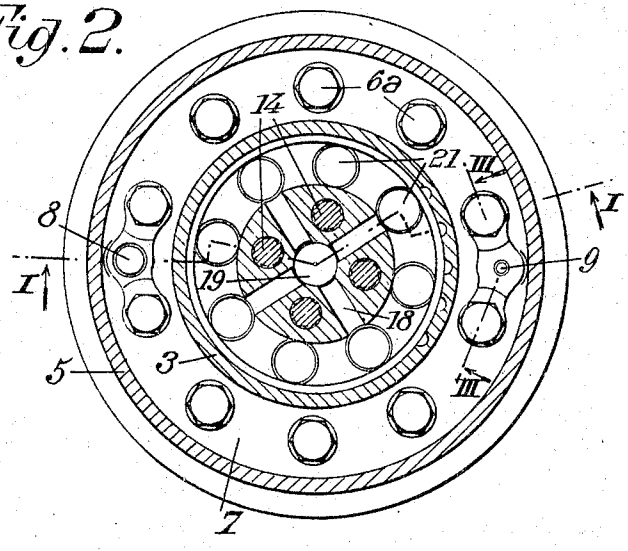


Fig. 2.



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Fig. 3.

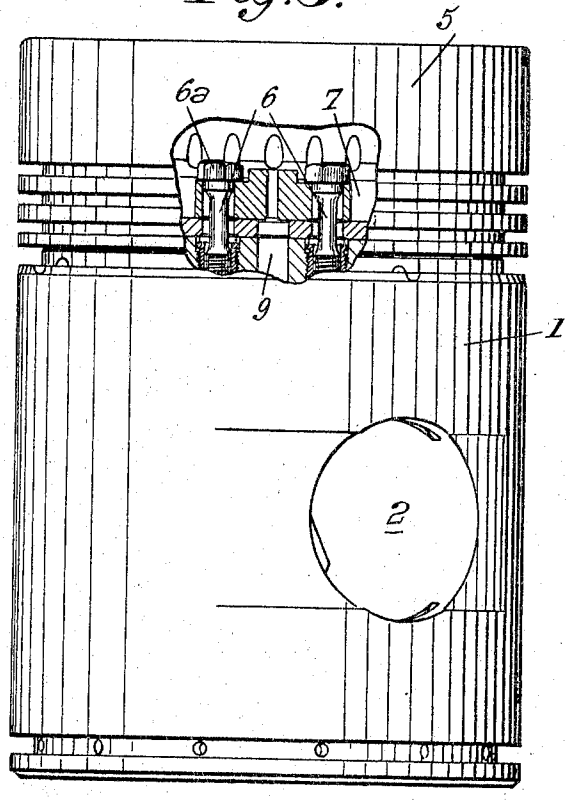
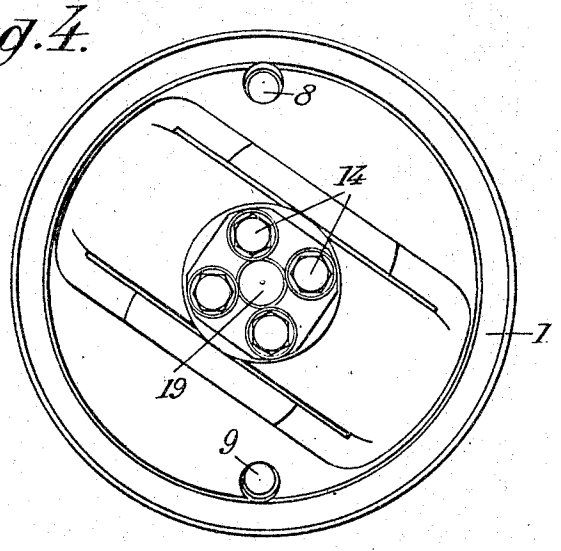


Fig. 4.



United States Patent Office 3,323,503 Patented June 6, 1967

3,323,503

PISTONS COMPRISING AN INNER COOLING CIRCUIT

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Filed Oct. 18, 1966, Ser. No. 587,504
Claims priority, application France, Oct. 22, 1965, 35,962
8 Claims. (Cl. 123—41.35)

The present invention relates to pistons, in particular for diesel engines, including an inner cooling fluid circuit fed with cooling liquid from a source external to said piston. The invention is more especially concerned with pistons of this kind the head of which is provided with a cavity forming a combustion chamber.

The chief object of our invention is to provide a piston of this type which is better adapted to meet the requirements of practice than those known up to now, in particular concerning cooling, fluid tightness of the cooling circuit, duration and facility of assembly.

A piston according to the present invention comprises a main body provided with a bore intended to accommodate the pivot axis of a corresponding connecting rod, a piston head secured to said body and an annular crown member surrounding said piston head and mounted with a fluidtight fit thereon, said annular crown member being secured to said main body by means of screws disposed at the periphery thereof, said piston head and said annular crown member being so shaped that, when they are assembled together, they leave between them a main annular chamber fed with cooling liquid from a source external to the pistons. According to our invention, the main body, the piston head and the annular crown member are arranged so that the heads of the screws are located in the main annular chamber, said screws being brought into position and tightened, before the mounting of the piston head, through the free space into which said piston head is to be secured subsequently.

A preferred embodiment of our invention will be hereinafter described with reference to the appended drawings, given merely by way of example, and in which:

FIG. 1 is an axial sectional view, on the line I—I of FIG. 2, of a piston made according to the present invention;

FIG. 2 is a cross section of said piston on the line II—II of FIG. 1;

FIG. 3 is an elevational view with parts cut away and parts in section on the line III—III of FIG. 2;

FIG. 4 is a bottom plan view of the piston of FIGS. 1 to 3.

The piston includes the following elements:

A main body 1, advantageously made of a light metal or alloy, provided with a transverse bore 2 intended to accommodate the pivot axis of a corresponding connecting rod (not shown);

A piston head 3 made of a refractory material, such as refractory steel, but which may also be made of ordinary steel, aluminum bronze, and a copper alloy having a high thermal conductivity coefficient, said piston head being provided with a cavity 4 intended to act as combustion chamber; and

An annular crown member 5 adapted to surround in a fluidtight manner said piston head 3. Said annular crown member 5 may be set, welded, brazed, around piston head 3. It is secured to the main body 1 of the piston by means of screws 6 located at the periphery thereof. For instance the number of said screws is ten.

Piston head 3 and annular crown member 5 are so shaped that, once they have been assembled together, they limit between them a main cooling annular chamber 7 preferably provided, as shown, with an annular recess 20 (or a series of recesses) extending toward the lip limiting the opening of cavity 4 and in which circulates a cooling liquid fed to said main annular chamber 7 through an inlet conduit 8 provided in the main body 1 of the piston. Evacuation of a portion of said cooling liquid takes place through a conduit 9, the other portion of said cooling liquid being evacuated through conduits which will be hereinafter mentioned.

The cooling liquid which, advantageously and as it will be hereinafter supposed, is the engine lubricating oil, may be introduced into inlet conduit 8 in any suitable manner, for instance in the form of a jet issuing from a fixed nozzle or again by means of a flexible or telescopic conduit.

According to the main feature of the present invention, main body 1, piston head 3 and annular crown member 5 are arranged in such manner that the heads 6*a* of fixation screws 6 are located in the main annular chamber 7, said screws being brought into position and tightened before piston head 3 is fixed in position, through the circular space into which said piston head is to be secured subsequently.

Thus, once the parts of the piston have been assembled together, the heads 6*a* of screws 6 are protected against the direct action of the hot gases during the operation of the engine to which the piston belongs, this action being very corrosive and therefore detrimental of a long duration of the piston. Furthermore, said screw heads 6*a* are efficiently cooled by the liquid circulating through the main annular chamber 7.

For this purpose, annular crown member 5 includes, near the end thereof remote from the active face of the piston, a fixation plate 5*a* provided with a set of orifices 10 for the passage of screws 6 into housings 11 provided in the body 1 of the piston opposite said orifices 10. Holes 21 are provided in said fixation plate 5*a* in order to reduce the weight thereof.

Preferably, as shown, instead of screwing screws 6 directly into the walls of housings 11 (which housings are provided in the main body 1 made of a light metal or alloy) the fixation of said screws 6 is reinforced by inserting, by screwing, into said housings, steel sleeves 12 which have been previously screw-threaded so as to cooperate with screws 6.

On the other hand, it is advantageous to provide a tubular distance piece 13 between the head 6*a* of every screw 6 and fixation plate 5*a*.

Screws 6 and distance pieces 13 can easily be brought into position through the circular opening provided in annular crown member 5 before piston head 3 has been fitted therein. This piston head 3 is advantageously set in position at the end of the assembly after annular crown member 5 has been temporarily expanded by heating.

Fixation of annular crown member 5 to the main body 1 of the piston may be further reinforced by a second row of screws 14 (for instance four of them) engaged through the inside of said main body 1, said screws 14 fitting in corresponding screw-threaded housings provided in piston head 3.

Advantageously the piston further comprises a supplementary cooling chamber 16 provided in piston head 3 and fed with oil from the main annular chamber 7 through radial conduits 17 ensuring the outflow of a portion of the cooling oil from said annular chamber 7. Said supplementary annular chamber 16 communicates, through other radial conduits 18 with an axial conduit 19 provided in the main body 1 of the piston and permitting the oil that has flowed through conduits 17, sup-

plementary annular chamber 16 and conduits 18 to lubricate the pivot axis of the connecting rod.

In a general manner, while the above description discloses what we deem to be a practical and efficient embodiment of our invention, said invention is not limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the invention as comprehended within the scope of the appended claims.

What we claim is:

1. An internal combustion engine piston which comprises, in combination,

a piston main body provided with a transverse bore,

a piston head fitting on said body,

an annular crown member surrounding said piston head and mounted with a fluidtight fit thereon,

screws bearing on said crown member and screwed in said main body for securing said crown member to said main body,

said piston head and said crown member being shaped to leave between them a main annular chamber for circulation of a cooling liquid,

said main body, piston head and annular crown member being so shaped that said screws have their heads located in said main annular chamber and are adapted to be tightened, before said piston head is secured in position, through the space into which said piston head is to be positioned.

2. A piston according to claim 1 wherein said piston head is provided with a recess forming a combustion chamber.

3. A piston according to claim 2 wherein said piston head is made of a copper alloy having a high coefficient of thermal conductivity.

4. A piston according to claim 1 further comprising a fixation plate integral with said annular crown member, said plate being provided with orifices for the passage of said screws.

5. A piston according to claim 4 further comprising steel sleeves screwed in said main body and provided with internal screw threads to accommodate said screws.

6. A piston according to claim 4 further comprising a tubular distance piece provided between the head of each of said screws and said fixation plate.

7. A piston according to claim 1 further comprising other screws engaged from the inside of said main body, said piston head being provided with screw-threaded housings to accommodate said last mentioned screws.

8. A piston according to claim 1 wherein said piston head is provided with a supplementary annular chamber, radial conduits between said first mentioned annular chamber and said supplementary annular chamber and conduit means in said main body for connecting said supplementary annular chamber with said transverse bore of said main body.

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