June 1, 1948. E. B. GRAHAM 2,442,408

PISTON COOLING CONSTRUCTION

Filed Nov. 29, 1945 2 Sheets-Sheet 1

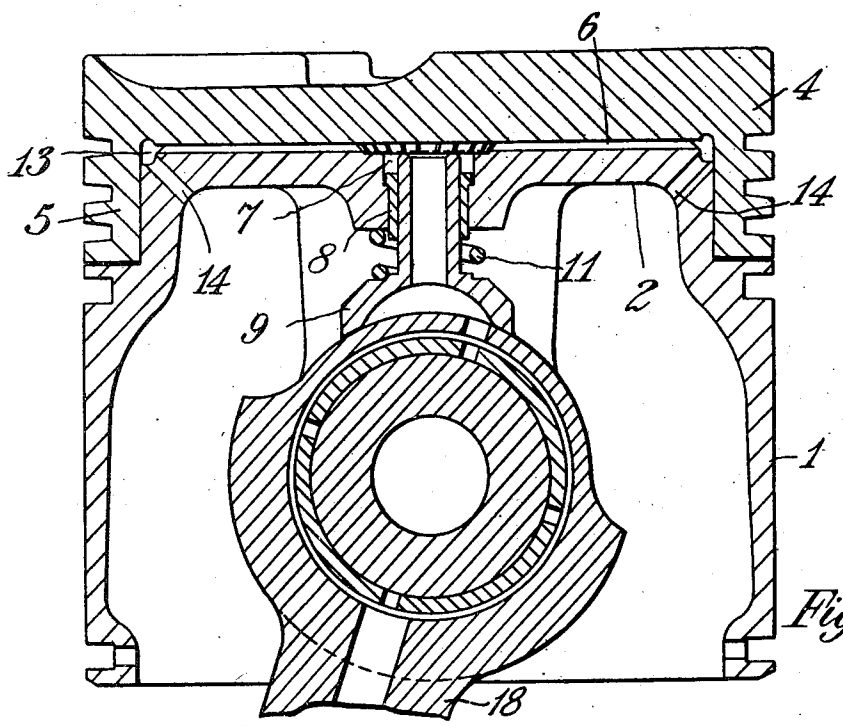


Fig. 1.

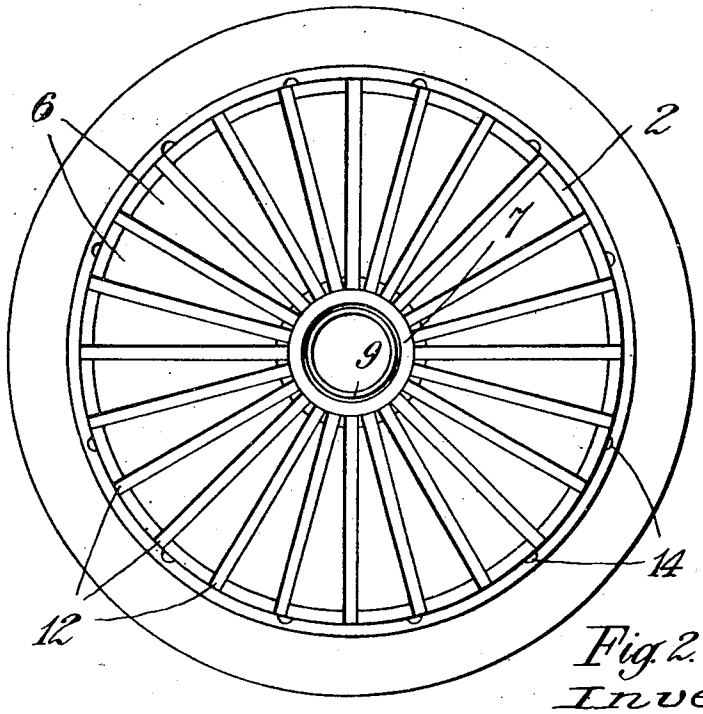


Fig. 2.

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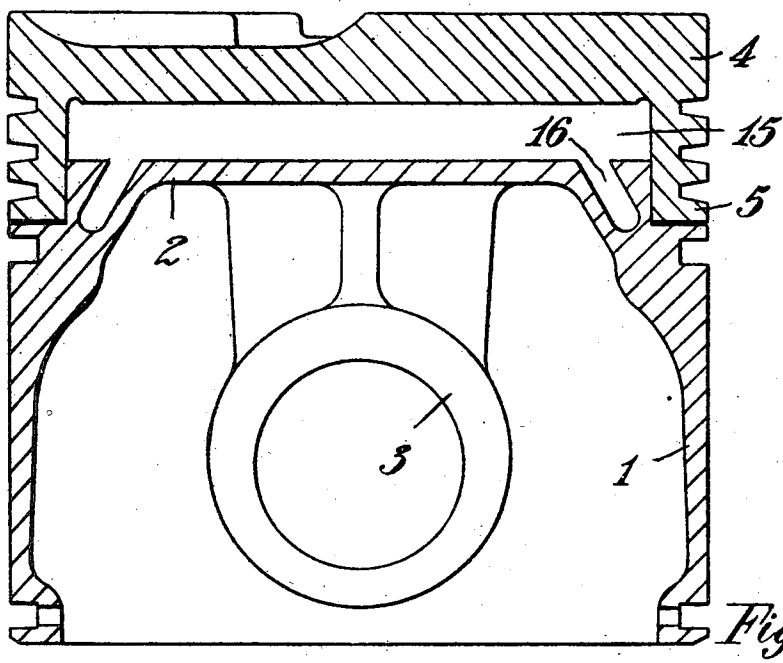


Fig. 3.

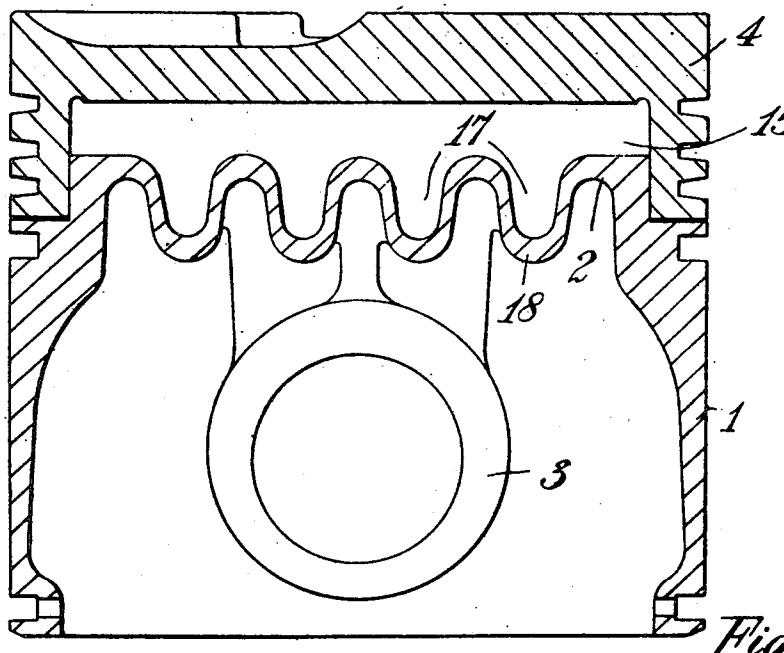


Fig. 4.

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UNITED STATES PATENT OFFICE

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PISTON COOLING CONSTRUCTION

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1 Claim. (Cl. 123—176)

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This invention relates to piston cooling construction in which the portion of the piston constituting the head or crown is an element separate from but connected with that portion of the piston of which the skirt forms part.

Numerous constructions of this type are known and in some cases that portion which provides the head or crown is arranged in association with the body portion so that a chamber is provided which may contain a medium adapted to promote the transfer of heat from the crown to the walls of the piston or provide a chamber through which a cooling medium, normally oil, may be caused to travel in the operation of the piston.

Various means for effecting the connection between that portion which provides the head or crown and the body of the piston have been proposed to be employed, the portion providing the crown in some cases being arranged in screw-threaded engagement with the body portion or being otherwise secured to the body portion by screw-threaded elements.

In some cases the element which provides the head or crown is formed also with grooves in which compression rings may be engaged.

The invention consists broadly in a piston of which the element providing the crown or head is recessed to provide a peripheral flange for engagement about the external periphery of the body portion of the piston.

Thus the connection between the element providing the crown or head and the body of the piston are in spigot and socket engagement, the body of the piston being formed as the spigot element.

Normally, in accordance with the invention, the peripheral flange on the element providing the crown or head will be so dimensioned that in it there may be provided grooves for the accommodation of compression rings.

In some cases the flange of the element providing the head or crown may be arranged to accommodate or otherwise engage a ring carrier formed of a material other than that of which the element itself is formed and for instance a ring carrier of austenitic iron or steel, bronze or other metal or alloy.

The body of the piston may be closed or substantially closed at its upper end, in which case between it and the element providing the crown or head there may be left a space adapted to contain a body of material which at the working temperature of the piston is liquid and will operate to promote the transfer of heat from the crown or head to the body or skirt of the piston.

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Where the arrangement is such that this space is closed or is provided with a removable closure element, within it there may be contained a body of material for instance sodium or a mixture of salts which at the working temperature of the piston is liquid and has a low vapour pressure.

Where, on the other hand, there is communication between the space and the interior of the piston body, means may be provided for injecting into the space a cooling medium for instance by way of the piston rod in a generally known manner, an oil passage being for instance provided in the piston rod in communication with a member associated with the body of the piston by which the oil may be caused to enter the space between the element providing the crown or head and the body of the piston.

In such case the space may be formed as a plurality of channels radiating from the axis of the piston, the angles between the channels being proportioned to secure a desired distribution of the oil for promoting for instance uniformity of temperature of the crown or head.

Where the body portion of the piston is closed at its upper or outer end or is provided with a removable closure element or is provided with perforations adapted to permit cooling liquid introduced into the space between it and the element providing the crown or head, a recess or a plurality of recesses may be provided in the end of the body of the piston to permit cooling medium to travel downward a desired distance toward the position of the groove for the lowermost compression ring.

Optionally in accordance with the invention the closed end of the body portion of the piston may be provided with ribs arranged radially or otherwise to promote cooling, the end thus being corrugated so that registering with the ribs or elevations formed on the inner surface of the piston there are channels in the outer surface.

Where the body portion of the piston is open at both ends or where it is arranged to be engaged by the element providing the crown or head without leaving any substantial space the primary utility of the invention is to be found in the possibility of removing the element in question from the body of the piston and replacing it by a new element should it become worn or otherwise deteriorated in use.

This possibility is also provided for in other constructions within the scope of the invention but in addition in these other constructions there is provided a space for the accommodation of a material operating to promote cooling of the head

or crown and also in some cases more or less of that zone of the piston in which the grooves for the compression rings are located.

The connection between the element providing the head or crown and the body of the piston may be secured in any convenient way.

Thus in accordance with the invention where the element and the body are formed of material possessing the same or a like coefficient of expansion to heat the head may be shrunk on to the body portion and connection may be secured by providing the element internally with a screw thread engaging a corresponding external thread on the spigot portion of the body of the piston.

The connection may be secured conjointly by shrinking and by the employment of the screw-threaded connection of the character in question.

A further method of connection which may be employed is swaging.

The surface of that portion of the element providing the crown or head which may be regarded as its working surface, that is to say the surface which forms one wall of the combustion chamber in which the piston operates, may be of any suitable character.

It may be flat, convex or concave or formed locally with convex or concave portions and in the latter case be of the type in which the concavity forms part of the combustion chamber.

The body of the piston and the element providing the head or crown may be formed as above indicated of the same material or the one may be formed of a material other than that of which the other is formed.

Thus both of these elements may be formed of a ferrous metal or a non-ferrous metal such as a light metal alloy of any of the compositions suitable for use in the production of pistons.

Particularly where the element providing the head or crown is secured to the body of the piston by shrinking, the two elements are preferably formed of materials having a like coefficient of expansion or coefficients of expansion which correspond or are the same at or in the neighbourhood of the normal working temperature of the piston.

The invention will be described further in detail and by way of example with reference to the accompanying drawings, in which:

Figure 1 is a mid section through the entire piston perpendicular to the wrist pin.

Figure 2 is a top plan view of the pin boss and skirt portion, with the packing ring crown removed.

Figure 3 a second construction, and

Figure 4 a third construction.

In all of the drawings, 1 is the skirt of the body of the piston, 2 is the upper end, 3 the gudgeon pin bosses, 4 is the crown or head provided with a peripheral flange 5 for engagement about the external periphery of the upper part of the body portion of the piston and with grooves for packing rings.

The construction illustrated in Figure 1 is a construction designed to enable lubricating oil passing through a passage provided in the connecting rod 18 to be delivered into the space 6 and in this construction in the upper end of the body portion there is provided an aperture 7 in which is engaged a bush 8 in sliding engagement with which is provided a member 9 furnished with a surface 10 adapted to seat on the small end of the connecting rod, a spring 11 being provided for forcing the surface 10 into contact therewith.

In this construction the space 6 is radially grooved to provide a plurality of passages 12 as shown in Figure 2 for the flow of the oil in an outward direction to the circumferential groove 13 from which extend a plurality of passages 14 whereby the oil may be returned to the interior of the piston and thus to the sump of the engine.

The constructions shown in Figures 3 and 4 provide closed chambers 15 designed to be partly filled with a body of material having a low vapour pressure at the normal operating temperature of the piston, for instance sodium, to promote the transfer of heat from the crown 4 of the piston skirt, such transfer being assisted by the agitation of the body of the material in question set up in the operation of the piston.

In the case of the construction shown in Figure 3, adjacent to the periphery of the chamber in the upper face of the closed end of the body portion there is provided a circumferential recess 16 and in the case of the construction illustrated in Figure 4 there are provided a plurality of circular recesses 17 in which a large proportion of the sodium or like material will be accommodated when the piston is at rest.

The formation of the closed end of the body portion in this case provides ribs 18 which may be effective in promoting dissipation of heat by radiation.

I claim:

A piston for internal combustion and other engines including a body portion having radial grooves on the outer face thereof and a peripheral groove at the outer edge, an integral skirt portion extending rearwardly from the body portion, the outer edge of the body portion being reduced to provide an annular shoulder, a separate crown portion, a peripheral flange integral with the crown portion and formed of material possessing substantially the same coefficient of expansion to heat as the body portion and shrunk on the reduced outer end of the body portion so as to lie adjacent the shoulder and substantially flush with the skirt portion and maintaining the inner surface of the crown portion against the outer grooved face of the body portion, means for supplying a cooling medium centrally through the body portion to the radial grooves and means in the body portion for discharging the cooling medium from the peripheral groove.

ERIC BRADLEY GRAHAM.

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