ONE-PIECE PISTON

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ABSTRACT

A one-piece piston comprises a piston crown made of steel and a bottom component made of forged steel, and a cooling channel that is formed by welding the crown and the bottom component of the piston together. The cooling channel is located radially behind the annular grooves. The crown and the bottom component of the piston jointly form a central cooling chamber whose lower limiting wall is forged as one piece with the bottom component of the piston. The welding seams joining the crown and the bottom component of the piston are friction welding seams. The piston provides for superior cooling of the crown of the piston and simplifies the production of the welding seams.
ONE-PIECE PISTON

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The invention relates to a one-piece piston with annular grooves for receiving piston rings, having a piston crown made of steel and a lower piston component made of forged steel. There is a cooling channel for receiving cooling oil and formed by welding seams formed by friction welding that join the piston crown and lower piston component. A central cooling chamber is formed jointly by the piston crown and the lower piston component, where the floor of the chamber is forged to be one piece with the lower piston component.

[0003] 2. The Prior Art

[0004] One-piece pistons are known from German Patent No. 30 32 671 A, FIG. 2. The known piston consists of a bottom steel component and a top steel component, which are joined with each other by welding, forming a cooling channel. No detailed statements are made concerning the welding method employed in this process. The representation of the welding seams suggests that conventional welding methods are used, for example such as the MAG welding method.

[0005] One drawback of the known piston is that the piston crown is not cooled within the radial inner zone or in the trough. A further drawback is that welding effects cannot be excluded in conjunction with conventional welding methods, and that access is made more difficult for the welding torch especially if the combustion troughs are deep.

[0006] German Patent No. DE 41 34 528 discloses that, in conjunction with multi-component pistons, in particular with pendulum shaft-type pistons, it is possible to produce a closed cooling channel by friction welding. Moreover, it is known from French Patent No. 15 89 247, FIG. 4, to produce a central, closed cooling chamber by friction welding.

SUMMARY OF THE INVENTION

[0007] It is an object of the invention to provide a piston that allows for cooling the crown of the piston in a simple yet effective manner, as well as of simplifying the manufacture of the piston.

[0008] This object is accomplished according to the invention by a one-piece piston with annular grooves for receiving piston rings, comprising a piston crown made of steel and a lower piston component made of forged steel. An outer cooling channel for receiving cooling oil is formed by welding seams formed by friction welding that join the piston head with the lower component. The cooling channel is arranged at least partially radially behind the annular grooves.

[0009] The piston crown and lower piston component jointly form a central cooling chamber for receiving cooling oil. The lower limiting wall (bottom) of the cooling chamber is forged to form one piece with the lower piston component.

[0010] The special advantage of pistons as defined by the invention is that a separate lower sheet metal cover that must be joined with the piston by clamping, welding, flanging or in some other way to form a bottom for a cooling chamber or cooling channel, is not required either for the outer channel or for the inner cooling chamber.

[0011] The cooling oil is supplied to the outer cooling channel, subsequently flows through overflow openings in a radially inward manner into the central cooling chamber, and then exits from the piston via one or several openings located in the lower wall defining the central cooling chamber.

[0012] The edge of the piston's combustion trough can be optionally provided with a reinforcement, which is produced by friction welding from highly heat-resistant steel, for example from a valve-type steel. In this way, cracking is prevented from occurring around the edge of the trough.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] Other objects and features of the present invention will become apparent from the following detailed description considered in connection with the accompanying drawings. It is to be understood, however, that the drawings are designed as an illustration only and not as a definition of the limits of the invention.

[0014] In the drawings, wherein similar reference characters denote similar elements throughout the views:

[0015] FIG. 1 shows the cross section of a piston as defined by the invention in the direction of the piston pin; and

[0016] FIG. 2 shows the cross section of a piston as defined by the invention in the thrust-counterthrust direction.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0017] FIGS. 1 and 2 show a one-piece piston 1, which comprises a piston crown 2 and a lower piston component 3. The two components are joined with each other by welding, forged or flow-pressed steel. A cooling channel 5 is located in the radially outer zone of the piston behind annular grooves 4. Cooling channel 5 is produced by joining crown 2 and lower component 3 of the piston by welding. The welding beads, which are not turned, illustrate that the two welding seams 6 and 7 are seams of friction welding. A cooling chamber 8 is located at about the level of cooling channel 5 in the interior of the piston below the combustion trough.

[0018] Lower limiting wall 9 of cooling chamber 8 is at least partially forged or flow-pressed so as to form one piece with lower component 3 of the piston, and is consequently not formed by a separate sheet metal component that is joined with the piston, for example by clamping, as it is frequently described in the prior art. Overflow openings 10 are drilled into lower component 3 of the piston between cooling channel 5 and cooling chamber 8.

[0019] The filling level within cooling channel 5 and in cooling chamber 8 can be adjusted by vertical tubes known in the prior art.
Accordingly, while only one embodiment of the present invention has been shown and described, it is obvious that many changes and modifications may be made thereunto without departing from the spirit and scope of the invention.

What is claimed is:

1. A one-piece piston with annular grooves for receiving piston rings, comprising:
   a piston crown made of steel;
   a lower piston component made of forged steel;
   a cooling channel for receiving cooling oil, said cooling channel being formed by two welding seams formed by friction welding, said seams joining the piston head and the lower piston component with each other and being arranged at least partially in a radial manner behind the annular grooves; and
   a central cooling chamber for receiving cooling oil formed jointly by said piston crown and lower piston component, said central cooling chamber having a lower limiting wall that is forged so as to form one piece with the lower piston component.

2. The one-piece piston according to claim 1, wherein overflow openings are provided between the cooling channel and the central cooling chamber.

3. The one-piece piston according to claim 2, wherein at least one drain opening for the cooling oil is provided in the central cooling chamber.

4. The one-piece piston according to claim 1, wherein the piston crown is made of a highly heat-resistant material.

5. The one-piece piston according to claim 4, wherein the piston crown is made of valve-type steel.