Jan. 12, 1937. A. DEBELACK 2,067,314

PISTON

Filed April 2, 1936

Fig.1

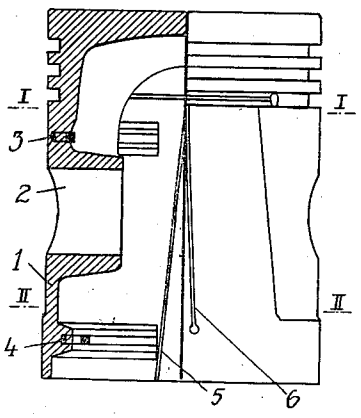


Fig.3

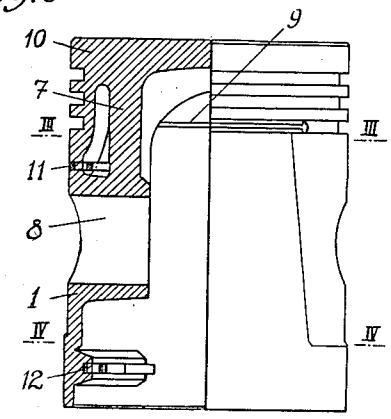


Fig.2

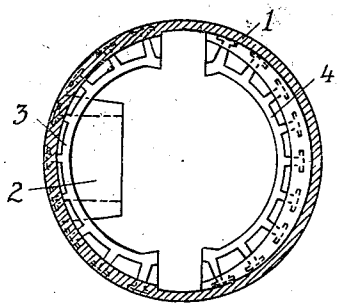


Fig.4

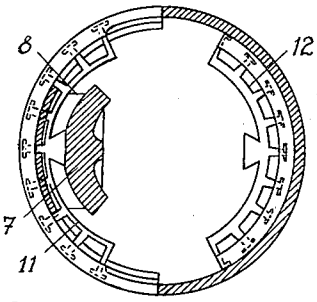


Fig.5

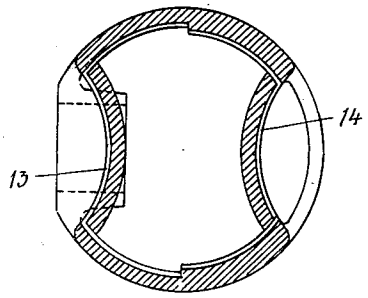
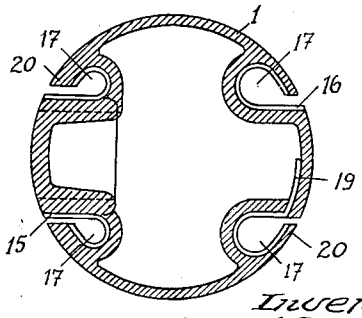


Fig.6



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2,067,314

PISTON

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Application April 2, 1936, Serial No. 72,429

5 Claims. (Cl. 309—13)

This invention relates to pistons, especially for internal combustion engines, in which the shell comprises two metals having different coefficients of heat expansion united in such manner as to produce a bi-metallic effect, accompanied by alterations in curvature so that the shell of the piston becomes accommodated to the expansion of the cylinder; that is to say, the bi-metallic action can be so adjusted that the bearing surface of the piston has the same expansion as the cylinder. For special purposes, the expansion could even be rendered negative.

The metal inserts which are employed to produce the bi-metallic action and which have a different coefficient of expansion from the shell, are usually provided, above and below, in the skirt of the piston, and, for reasons of cheaper production, inserts of the same metal are employed in both places, being arranged at the same distance from the wall of the skirt.

However, when such a piston is in operation it is found that, in accordance with the described constructional design, a greater degree of expansion occurs in the upper portion, where the piston rings are located, than lower down, by reason of the higher working temperature prevailing in the upper portion. No alteration is obtained by doubly splitting the piston at the top alone (a measure that is known to facilitate the bi-metallic action of the piston wall). In order to find at least a partial remedy, the piston had to be tapered, and therefore allowed increased play at the top, especially when the skirt was split on one side only, or left solid.

An object of the present invention is to produce a more powerful bi-metallic action in the upper piston portion, where the piston rings are disposed, than lower down the skirt.

According to the invention, and taking into account the higher working temperature in the upper piston portion, the upper and lower inserts are different in arrangement or manufacture. For example, the upper insert strips may be located nearer the periphery (the outer wall of the piston) than the lower ones. Alternatively, for producing the same effect, the upper inserts may be composed of a metal having a coefficient of expansion which differs more from that of the piston skirt than does the metal of the lower inserts, in which case the spacing in relation to the wall of the piston is or may be the same for both upper and lower inserts.

Typical embodiments of the invention are illustrated on the accompanying drawing.

Fig. 1 shows one embodiment, the left half of the figure representing an axial section of the piston, and the right half being a side elevation.

Fig. 2 shows, on the left, a cross section along I—I of Fig. 1, and, on the right, a cross section along II—II of the same figure.

Fig. 3 represents a second embodiment, in axial section on the left, and in side elevation on the right.

Fig. 4 shows, on the left, a cross section along III—III of Fig. 3, and, on the right, a cross section along IV—IV of the same figure.

Fig. 5 represents two corresponding cross sections of another embodiment, the arrangement of the upper insert being shown on the left, and that of the lower one on the right.

Fig. 6 represents two corresponding sections of a fourth embodiment, the upper insert being shown on the left, and the lower one on the right.

In the first embodiment (Figs. 1 and 2) the gudgeon-pin bosses 2 project, on both sides, from the shell 1 into the interior of the piston. The shell 1 is provided with a longitudinal slit 5, extending up and down, and with an upper longitudinal slit 6. The upper and lower inserts 3 and 4, are arranged in such a manner that the upper insert 3 is brought nearer to the outer periphery of the piston wall, than the lower one 4. By this means the bi-metallic action is more powerful above than below.

The piston illustrated by Figs. 3 and 4 is devoid of longitudinal slits. It has struts 7 located on the bosses 8. Over the greater portion of its perimeter, the head 10 of the piston is separated from the shell 1 by a slit 9. The upper insert ring 11 is also, in this case, located nearer to the outer wall of the piston shell than is the lower one 12, so that a more powerful bi-metallic effect is produced above than below.

The described arrangements, in which similar materials are employed for the upper and lower inserts, and the increased bi-metallic action is obtained by approaching the upper insert closer to the outer perimeter of the piston skirt, provides the further advantage that, in consequence of the unconditionally uniform shape of the insert strips (as the result of the sectional form), a progressive bi-metallic effect occurs, since the insert strips are cast-in eccentrically in relation to the periphery of the piston. Consequently, the bi-metallic effect is more powerful in the middle than at the ends.

By this means it is possible to get rid of the so-called "abrasion corners", which may be more strongly affected bi-metallically, whereas the

middle portions of the piston skirt, that is at the ends of the bi-metallic strip, have a weaker effect. Experiments have shown that the bi-metallic effect is produced with extraordinary precision, and even an unintentional deeper seating of the inserts, in casting in the shell, is noticeable in its expansion.

The term "abrasion corners" denotes the places where the piston usually abrades, that is, the lateral ends of the upper bearing surface, since it is known that high specific expansion of the skirt, owing to the heat generated in running, is accompanied by distortion due to the still hotter piston head, which is attached to the skirt at the bosses and thereby transmits its greater expansion at that point. These abrasion corners, which constitute the most critical point in the problem of the play of the piston, are now rendered harmless by the arrangement according to the invention, so that the question of initial clearance also appears to be settled.

In the third embodiment (Fig. 5), upper and lower inslitted inserts 13 and 14 are guided externally by the bosses, and, internally, between them, by the inner wall of the shell of the piston, the upper inserts 13 being, in their interiorly guided parts again situated nearer to the periphery of the piston skirt than are the lower inserts 14.

The same applies to the fourth embodiment (Fig. 6) in which the upper inserts 15 and the lower inserts 16 are solely arranged, on the outside, in external longitudinal recesses 17 formed by the special design of the piston shell 1; but can also be guided on the inside (19) if desired. In the parts 20 of the shell, which cover the recesses, the upper inserts are located nearer the external periphery of the shell than is the case with the lower ones, so that, in this case again, the more powerful bi-metallic effect occurs at the top.

According as the bearing surfaces of the piston are split or solid, the skirt must be circular, in the former case, and of oval cross section in the latter, so as to leave room for the inserted material on the bearing surface which, in consequence of the bi-metallic action, now expands in the lateral direction only.

I claim:—

1. A skirted piston having in its skirt upper and lower metal inserts differing as to coefficient of expansion from the metal of the piston and affording greater bi-metallic action of the upper skirt portion than the lower skirt portion.

2. A skirted piston having in its skirt upper and lower metal inserts differing as to coefficient of expansion from the metal of the piston and from one another thereby to afford greater bi-metallic action of the upper skirt portion than the lower skirt portion.

3. A piston according to claim 2, the upper and lower inserts being similarly spaced from the outer periphery of the skirt.

4. A skirted piston having in its skirt upper and lower metal inserts differing similarly as to coefficient of expansion from the metal of the piston, said upper insert being located nearer to the outer periphery of the skirt than the lower insert thereby to afford greater bi-metallic action of the upper skirt portion than the lower skirt portion.

5. A piston according to claim 4, the inserts being disposed eccentrically in relation to the periphery of the piston.

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