March 16, 1937. E. MAHLE 2,074,228

LIGHT METAL PISTON

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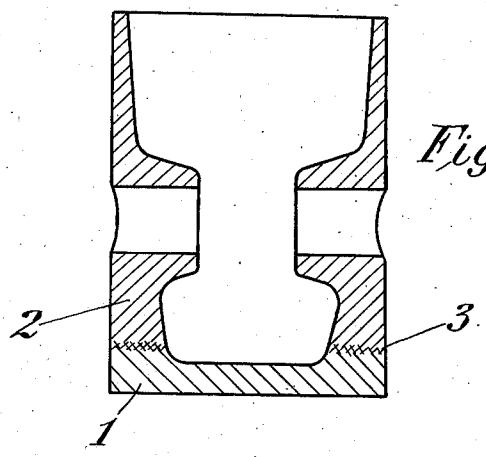


Fig. 1.

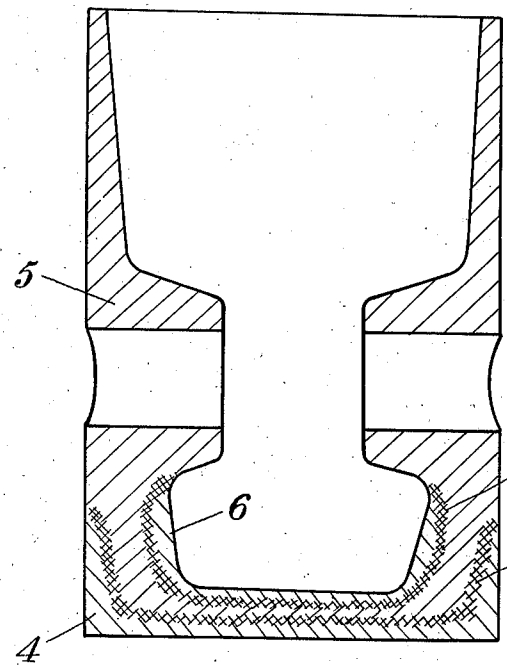


Fig. 2.

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LIGHT METAL PISTON

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3 Claims. (Cl. 309—14)

This invention relates to a light metal piston for internal combustion engines and has the object of taking into account in a new and advantageous manner, the different stresses in the various parts of the piston and the properties of the material which are desirable in such parts.

The piston head of a Diesel engine piston may, while working, be heated at the point of injection up to about 440° C. and has to withstand explosion pressures up to 90 atmospheres. These stresses would undoubtedly lead to destruction of the end of the piston, which would develop chinks as a result of these high stresses and would then burn through if the material did not possess good thermal conductivity, strength and capability of expansion. In contradistinction thereto for the working surface of the piston a material of great resistance to wear is required in view of the constant sliding friction in the cylinder. At the same time the thermal expansion of the piston material in this zone should be as small as possible in order that the clearance allowed may be small so as to obtain rapid running in of the piston without piston slap.

Attempts have been made to meet these various requirements by constructing so-called bi-metal pistons. Thus, for example, constructions are known in which a light metal piston is fitted with a heavy metal head plate. It is also known to combine a light metal piston head with a skirt of steel or cast iron by casting or screwing together. This type of piston however, has not come into general use. Its manufacture is made considerably more expensive because the heavy metal part of the piston has to be made separately. In addition, special chill moulds are necessary for casting the head part together with the heavy metal skirt, or the mechanical combination requires considerable time. Finally, it is possible for the heavy metal part to become loose after running for some time because the strength of a homogeneous piece cannot be obtained.

It is the object of the invention to produce a piston in which the different stresses and the necessary properties of the separate zones of the piston are taken into account without the above disadvantages of the hitherto known constructions arising. According to the invention the new piston consists of two or more alloys of different compositions, the joining together of which is effected with the formation of an intermediate alloy at a degree of heat lying above the working temperature of the piston. In this way a homogeneous body is obtained with material of different properties in definite zones. The manufacture is effected by casting and it is also possible to cast shaped articles consisting of several layers of alloy and to press them into piston blanks.

The invention offers the possibility of retaining the hitherto usual piston constructions of all kinds, for example, pistons with inserted strips for regulating the thermal expansion and all constructions of piston which have hitherto been found advantageous. Taking into consideration the specific gravities and the setting temperatures of the individual alloys, the intermediate alloy zones of the separate layers can be determined by suitably timing the sequence of the individual casting operations, and, if necessary, varying the type of the casting operation. Thus, for example, in the casting process the separate fluid alloys can be supplied without pressure or under pressure at the same inlet or separately. When there are several inlets they may be arranged at different heights, and according to the conditions prevailing the plane of the end surface or the edge of the skirt of the piston may coincide with the base of the chill mould. It has already been mentioned that with pressed pistons by arranging the alloy layers in a particular manner corresponding to the different stresses of the separate zones of the piston, blanks for making rough-pressed pistons can be obtained.

The invention is illustrated diagrammatically and by way of example in the accompanying drawing.

Fig. 1 is a longitudinal section of a piston consisting of two alloy layers with a boundary zone running substantially in a plane.

Fig. 2 is a longitudinal section of a piston in which a number of layers of different alloys are employed and the boundary zones are curved.

The piston according to Fig. 1 shows two alloys 1 and 2 superposed. The intermediate alloy zone is indicated by 3 and extends approximately in a transverse plane. The alloy 1 may be, for example, an aluminium-copper alloy with good thermal conductivity; strength and expansion, and the alloy 2 may be an aluminium-silicon alloy with small thermal expansion and good wearing properties. The piston according to Fig. 2 is composed of several alloy layers 4, 5 and 6. The alloys 4 and 6 may have similar properties. In the example illustrated the boundary zones or intermediate alloy layers 7 and 8 are curved.

What I claim is:—

1. A piston for internal combustion engines, comprising a plurality of sections respectively

formed of an alloy lighter in weight than ordinary cast iron, said sections respectively having a different composition, and being joined together by an intermediate alloy bond consisting of a part of the material comprising said respective sections.

2. A piston for internal combustion engines, comprising a plurality of sections respectively formed of an aluminum alloy, said sections respectively having a different composition and being joined together by an intermediate alloy bond consisting of a part of the material comprising said respective sections.

3. A piston for internal combustion engines, comprising a plurality of sections respectively formed of an alloy lighter in weight than ordinary cast iron, said sections respectively having a different composition, and being joined together over a curved surface by an intermediate alloy bond consisting of a part of the material comprising said respective sections.

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