

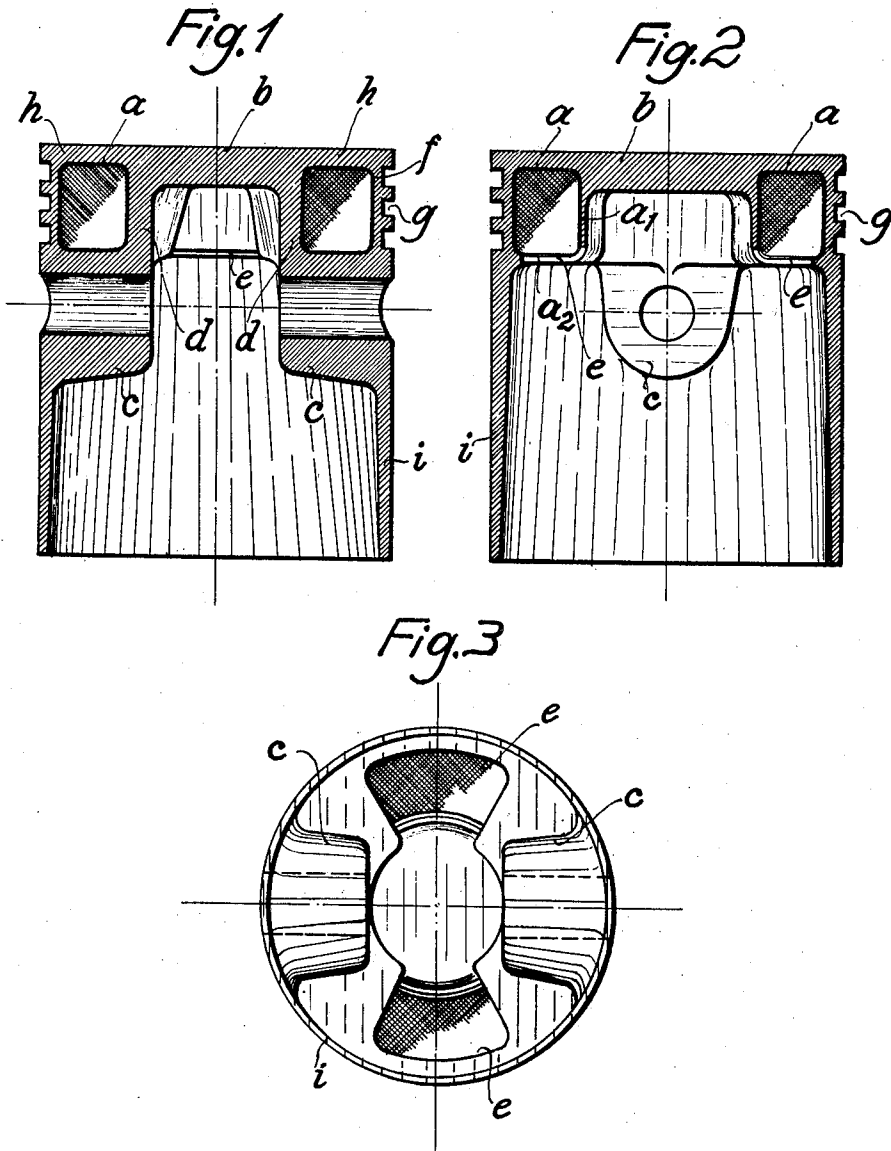
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PISTON FOR INTERNAL COMBUSTION ENGINES

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UNITED STATES PATENT OFFICE

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PISTON FOR INTERNAL COMBUSTION ENGINES

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My invention relates to improvements in pistons consisting of a light metal or of alloys of such metals and intended for use in internal combustion engines.

5 As the materials of pistons of this kind have a greater coefficient of expansion than the material, generally cast iron, of which the cylinder is made, provision has been made to allow the piston to freely expand within the
10 cylinder or the piston has been constructed in such a manner that when cold it snugly fits into the cylinder walls but is allowed to undergo deformations under the action of heat so as to prevent gripping or freezing on
15 the cylinder walls.

My present invention resides on the consideration that no precautions or provisions with respect to the dimensions or to the execution of the piston in view of heat expansion would be necessary if the heat entering
20 from the combustion chamber through the head of the piston into the piston itself could be successfully carried away so rapidly that the heat in the material of the piston does not manifest itself by expansion phenomena.
25 This of course cannot be attained in an absolutely perfect manner but provision can be made to prevent accumulation or banking up of heat and consequently also to prevent considerable expansions in the material of the piston. These provisions may consist, when
30 making use of the usual alloys of light metals for the manufacture of the piston, in supplying the inner surface of such a piston with a covering or lining of a metal, for example
35 copper, or of an alloy which has a greater power to give off heat than the material itself of which the piston is made. The heat of the piston material is then given off more
40 rapidly to the medium filling the interior of the piston, i. e. air or oil, than in the case of the absence of the covering or lining, the consequence being a material decrease of the heat expansion of the piston.

45 Furthermore constructing the piston so as to have on the innerside of its head extensions or projections which in consequence of their dimensions or shape have a low resistance against heat conduction, it is possible to
50 attain a deviation of the heat flow away from

the skirt of the piston towards the interior of the piston, so that the skirt is heated only to a relatively small degree and consequently does not expand at all, practically speaking, because the main part of the heat is conducted to a place in the interior of the piston, where this heat is rapidly given off to the medium in the interior of the piston by means of the covering or lining of excellent heat conductivity.

In practice it has been found possible, by the use of this invention, to form a piston with a skirt which may be made to fit the cylinder snugly when cold and yet no gripping or freezing because of heat expansion will occur during operation and this is accomplished without providing slits or the like in the skirt to render it yielding.

One form of a piston according to my invention is illustrated in the accompanying drawings, which shows in Figs. 1 and 2 axial sections of the piston taken on two vertical plans perpendicular to each other, whereas Fig. 3 is a view from below.

In the represented example the said covering or lining of part of the inner wall of the piston with a metal of higher heat conductivity is carried out by embedding a hollow ring of copper *a* directly at the inner side of the piston. The hollow ring of copper *a* is, as may be seen in the drawing embedded between the head *b* of the piston and the bearing bosses *c* of the gudgeon of the connecting rod, this ring being put into the casting mould like a core, in addition to the core which corresponds to the hollow part of the piston; to this end a unitary core is sufficient. The hollow ring is entirely covered by the molten light metal poured into the mould and the core for the hollow part of the piston may be so shaped as to form between the hollow copper ring *a* and the cavity of the piston next the bearing bosses *c* relatively thick annular portions *d* (Fig. 1) consisting of light metal whereas, between the two bearing bosses *c*, the innerwall *a*₁ and the adjoining wall *a*₂ of the hollow copper ring *a* (which latter wall is directed towards the open side of the piston) define the cavity of the piston. When the piston is taken out of

the mould, its wall a_2 will be provided with perforations e (Fig. 3) or cut out totally between the two bearing bosses, so that the cavity of the ring a is brought into communication with the cavity of the piston. The air circulating in the cavity of the piston or the oil in this cavity can freely pass into cavity of the copper ring a and since this latter receives the heat from the head of the piston in the shortest way and gives it off very easily, the heat passing through it is rapidly transmitted to the medium circulating in the interior of the piston.

Besides, the piston may be so shaped that the thickness of its wall on the outer side of the copper ring a , particularly owing to the presence of the grooves g for the reception of the piston rings is considerably less than in the center of the head b of the piston and it is also less than the thickness of the wall between the copper ring a and the head b . The resistance against heat conduction therefore increases gradually towards the sliding surface of the piston so that the heat is more or less accumulated in the center of the piston head and is transmitted more easily to the copper ring than to the skirt i . The high coefficient of heat conductivity of the copper ring enables such a rapid giving off of the heat so that this heat is prevented from being conducted into the skirt i of the piston to a considerable degree.

The deviation of the stream of heat away from part f of the piston wall and away from the skirt i is favored by the relatively thick webs d (Fig. 1) through which part of the heat of the head b of the piston is conducted to the bearing bosses c and therefrom to the gudgeon of the connecting rod respectively to the rod itself so that also in this manner heat is carried away and prevented to flow towards the skirt i to a material degree.

Experiments have shown that a piston in conformity with the described example of an embodiment of my invention may be made to snugly fit into the cylinder when cold and that it does not expand in the normal operation as to cause an undue wear of the cylinder by abrasion or a freezing or gripping.

It is to be understood that the covering or lining of the inner wall of the piston with a better heat conducting material may be carried out also in other ways, e. g. by means of any metallizing process. Of course the inner wall in its totality may be provided with a covering or lining of the said kind to increase the power of giving off heat. The property of copper or of another material to possess a lower coefficient of expansion than aluminum or alloys thereof may be made use of. In uniting a layer of copper and a layer of aluminum so intimately as to form a compound material, this latter has then a lower coefficient of expansion than

aluminum or alloys thereof. Therefore when uniting the lining of the inner wall of the piston with the material of the piston by means of an intermediate layer which improves the firm adherence or by using mechanical means such as double tail feather and groove connection, or the like in such an intimate manner that relative movements of both layers are impossible, a double effect is secured, viz. (1) a rapid giving off of heat and (2) a decrease of the coefficient of expansion. This enables and facilitates giving to the piston a snug sliding fit bearing on the inner wall of the cylinder when cold.

Where in the specification and claims the expression "light metal" is used, this expression means "aluminum" and "aluminum alloys", such as alloys of aluminum with magnesium, copper and other metals. The range of metals is, however, not to be restricted just to these metals. The piston is essentially of a light metal. This expression is used in the art generally to mean a metal lighter than irons and steels and this use of the expression "light metal" is accepted by workers in this art. The metal which is adapted to give off heat rapidly is, therefore, a metal having a higher heat conductivity than the light metal.

What I claim is:

1. In combination with a piston consisting of light metal, a hollow ring of a material adapted to give off heat more rapidly than said light metal, said ring being embedded at the inner side of the piston head in the material of the piston, the said hollow ring and the piston material surrounding it being provided on the side towards the interior of the piston with perforations to permit a circulation through the cavity of the ring of the medium which fills the interior of the piston.

2. In combination with a piston consisting of light metal, a hollow ring of a material adapted to give off heat more rapidly than said light metal, said ring being embedded at the inner side of the piston head in the material of the piston, the said hollow ring and the piston material surrounding it being provided on the side towards the interior of the piston with perforations to permit a circulation through the cavity of the ring of the medium which fills the interior of the piston, the ring and the surrounding piston material being located in the space between the piston body and the bearing bosses for the gudgeons of the connecting rod.

In testimony whereof I affix my signature.
JOHANN WEISS.