July 12, 1938. E. W. SCHNEIDER 2,123,489

LIGHT METAL PISTONS FOR INTERNAL COMBUSTION ENGINES

Filed Jan. 22, 1936

Fig. 1

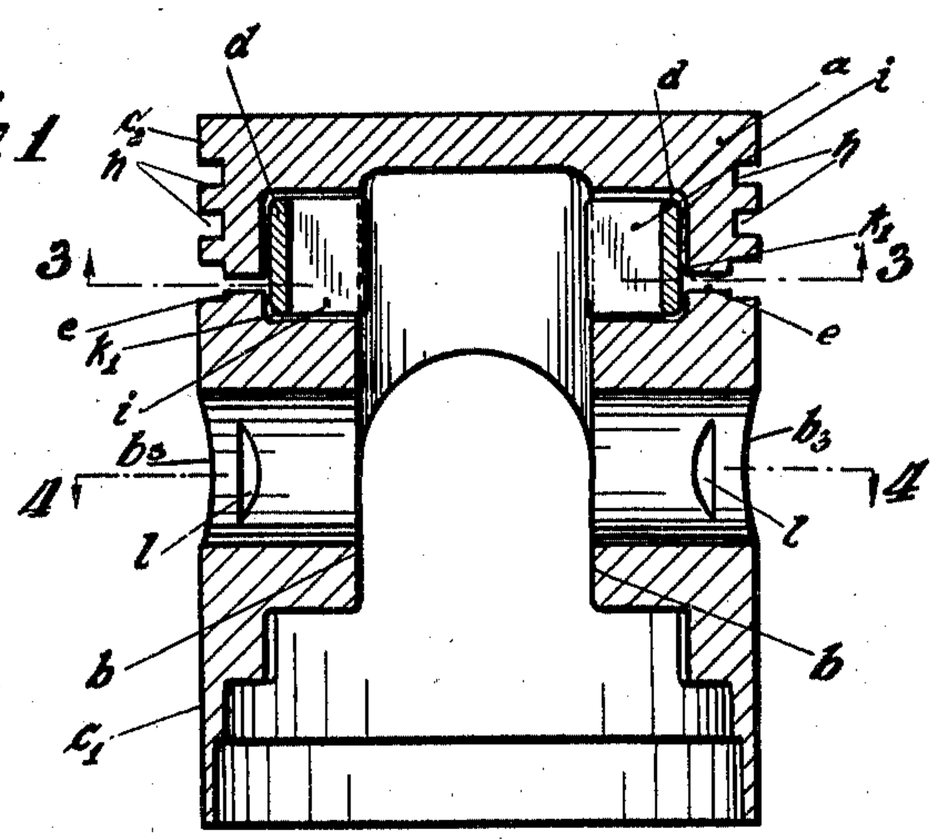


Fig. 5a.

Fig. 5

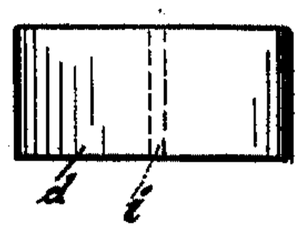


Fig. 2

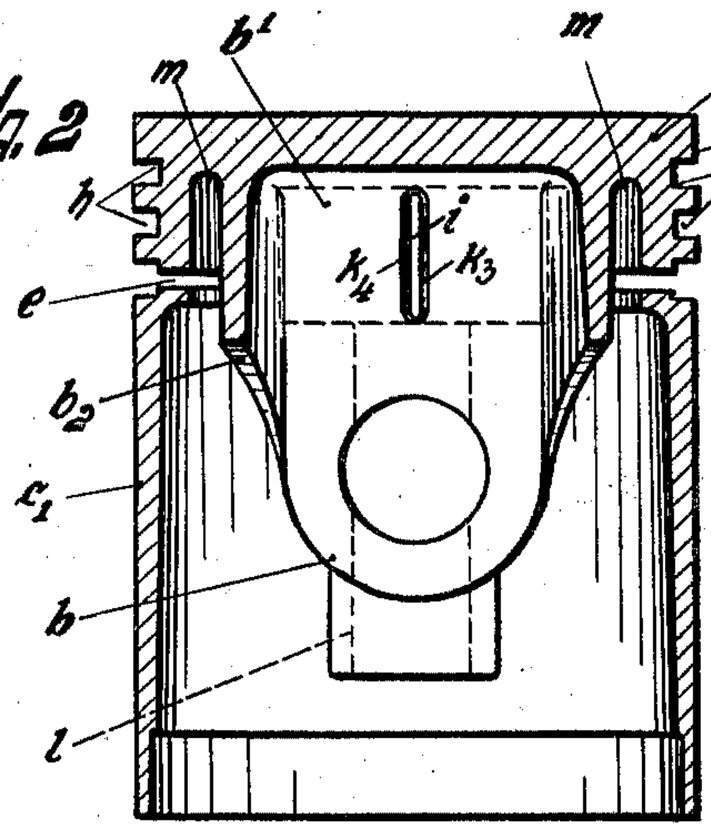


Fig. 4

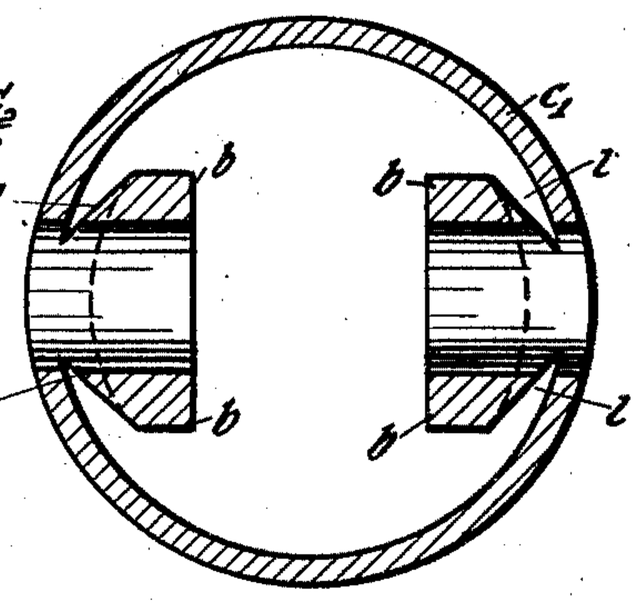


Fig. 6a.

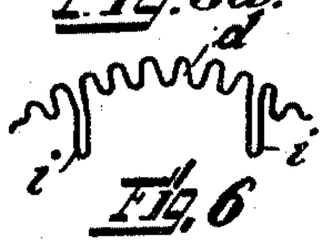


Fig. 6

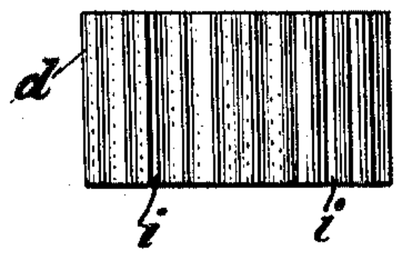
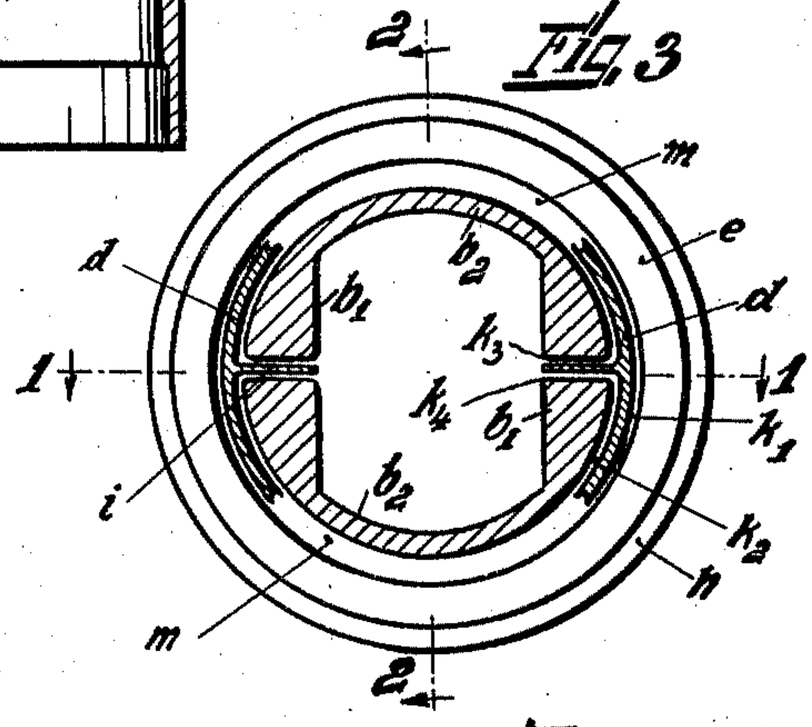


Fig. 3



Inventor

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LIGHT METAL PISTONS FOR INTERNAL COMBUSTION ENGINES

Ernst Walter Schneider, Berlin, Germany

Application January 22, 1936, Serial No. 60,212
In Germany January 23, 1935

1 Claim. (Cl. 309—9)

My invention relates to cast light metal pistons for internal combustion engines comprising an upper head portion having a side wall adapted to carry the piston rings and a lower skirt portion having piston pin bosses, said head portion and said skirt portion being separated by a circumferentially extending air gap and being integrally connected together by opposed thick webs, in vertical alignment with said piston pin bosses, depending from said head and being joined to said piston pin bosses.

In the light metal pistons already known, this connection is effected in two different manners.

According to the first manner the piston cover and the two bosses are integrally connected by means of intermediate webs the breadth of which is equal to or somewhat greater than the diameter of the bosses. According to the second manner the connection is made by an internal hollow cylinder coaxial with the piston mantle.

The first manner of connection did not prove a good one because, due to the irregular distribution of the masses, the heat as well as the pressures were not transferred uniformly and consequently, deformations of the piston mantle and wear and tear of the piston were caused.

In the second manner of connection, by means of an internal hollow cylinder, these disadvantages are partly removed but there arises the following disadvantage: The piston cover is not uniformly heated but heated most along that annular portion which lies in alignment with the internal hollow cylinder because at the circumference of the piston cover the heat is lead off by the wall of the cylinder while in the middle of the piston cover the heat is lead off by the oil sprayed against the piston cover when the motor is running. The internal hollow cylinder attached to said hot annular portion of the piston cover is relatively hot and lengthened to a correspondingly great amount. By the forces arising thereby both the piston cover and, by the intermediary of the bosses, the lower skirt portion of the piston are deformed. Besides, the manufacturing of such pistons by means of chill- (cocill-) casting presents considerable difficulty. The internal hollow cylinder must be separated from the piston skirt on its entire circumference by an annular air space. On a great part of the circumference, the core for forming this air space can be combined with, or can form part of the core for forming the piston skirt. However, those two parts of the annular air space which lie above the bosses must be provided for during the casting by means of special core-parts which must afterwards be rotated and drawn out. Such a chill (cocill) device is complicated and the manufacturing costs of the piston are increased.

The invention relates to light metal pistons made according to the second manner and has for its object to avoid the above-named disadvantages. In the light metal pistons constructed according to my invention, no deforming forces are produced by the heating of the parts. The piston retains on its entire length its accurate cylindrical form, even with the highest temperatures occuring during the working of the motor. Therefore, the piston can be finished into its accurate cylindrical form in contrast with the usual pistons which must intentionally be deformed during the manufacturing in order to equalize the deformations effected by the heat both at the circumference of the piston cover and at the outer surfaces of the bosses. The cost of the manufacturing of the new piston is diminished furthermore in that the piston can be cast in chills (cocills) in a simple manner and especially in that core-parts are avoided which afterwards must be drawn out. The manufacturing costs are diminished furthermore by the diminishing of the weight attained in my invention.

The present invention has for its object a piston of the first described type and comprising additional thin webs intermediate said thick webs, said thin webs depending also from said head and being joined to said piston pin bosses and being furthermore spaced inwardly from the side wall of said head, and a preformed metallic segment disposed in each of said thick webs, each of said segments having a lug extending inwardly therefrom and through a thick web, said metallic segments being spaced at least in part from the adjacent cast metal of the piston by spaces resulting from the shrinkage of said metal in cooling. By these shrinking spaces and by the air spaces which are provided for in the casting directly by the core, an uninterrupted annular heat insulating air gap is formed surrounding the internal hollow cylinder on all sides. On each of the two preformed metallic segments there are fixed one or several radially inwardly directed lugs or webs around which, during the cooling of the casting, likewise shrinking spaces are formed. By the shrinking spaces surrounding the lugs the internal hollow cylinder is subdivided, in the very thick parts of the hollow cylinder lying above the bosses. By this subdivision of the internal hollow cylinder great tensions are completely avoided, which would appear if the hollow cylinder be a closed one, since the shrink-

ing spaces are sufficient to receive the linear extensions of the wall of the internal hollow cylinder. Since in the piston according to my invention such extension forces do not exist and, therefore, forces and pressures, to be transferred by the hollow cylinder to the bosses, cannot take place, the dimensions of the hollow cylinder have to correspond only to the operating stresses. Hereby and by the diminution of the thickness of the wall of the piston skirt rendered possible by the fact that deformations of the skirt are avoided and, therefore, the original accurately cylindrical form is maintained, the weight of the piston is reduced to a considerable degree. That is besides the reduction of the costs of extreme importance for the rapidly rotating motors with regard to the great accelerating forces.

In order that the invention may be more fully understood reference will be had to the accompanying drawing in which

Fig. 1 is a vertical longitudinal sectional view of the piston on the line 1—1 of Fig. 3;

Fig. 2 is a vertical longitudinal sectional view on the line 2—2 of Fig. 3;

Fig. 3 is a transverse horizontal sectional view on the line 3—3 of Fig. 1;

Fig. 4 is a transverse horizontal sectional view on the line 4—4 of Fig. 1;

Figs. 5*a*—5 show a metal enclosure in plan view and vertical view;

Figs. 6*a*—6 show a modified metal enclosure in plan view and vertical view.

The light metal piston shown in the drawing is cast as a whole in the chill (cocill). *a* is the piston cover *b*, *b* are the two piston pin bosses by which the piston is pivoted to the connecting rod. The piston skirt consists of the lower skirt portion c^1 and the upper head portion c^2 provided with the grooves into which the piston rings are to be inserted. During the casting the portions c^1 and c^2 are integrally connected. They are separated afterwards by an annular groove *e* cut into the mantle. The bosses, *b*, *b* are connected with the piston cover *a* by an internal hollow cylinder separated on its entire circumference from the piston mantle c^1, c^2 by an insulating air gap. This hollow cylinder consists of two portions of greater thickness continuing the bosses upwardly, and to be separated during the casting from the skirt portion c^2 by air gaps in a manner to be described afterwards, and of two hollow cylinder portions b^2, b^2 of less thickness between which and the mantle portion c^2 ring sector formed air spaces *m*, *m* (see Figs. 2 and 3) are provided during the casting. The separation and insulation of the portions b^1 from the mantle part c^2 are effected by inserting preformed metallic segments *d* provided with radial lugs *i*. The metallic segments remain in the casting. During the cooling of the casting there are formed, the so-called shrinking spaces. By the shrinking spaces k^1 lying near the external cylindrical surfaces and by the shrinking spaces k^2 lying near the internal cylindrical surfaces of the segments, the portions b^1 of the internal hollow cylinder are separated from the mantle part c^2. By these shrinking spaces in combination with the above-mentioned ring-sector-formed air spaces *m*, *m* there is provided a space entirely surrounding the hollow cylinder b^1, b^2, b^1, b^2. By the shrinking spaces k^3, k^4, k^3, k^4 adjacent to the two sides of the lugs *i* each of the two thickened portions b^1, b^1 is subdivided into two parts separated one from another by air gaps. The air gaps are great enough to receive the linear extension of the hollow cylinder b^1, b^2, b^1, b^2 caused by the heating and thereby to prevent the generation of tension forces in the hollow cylinder and of deformations of the piston cover and the mantle.

The heat transferred from the piston cover *a* to the hollow cylinder b^1, b^2, b^1, b^2 is transferred from the hollow cylinder to the bosses *b*, *b* and from the bosses partly to the wrist pin and the connecting rod, and partly to the skirt portion c^1. For reducing the heat transferred to the piston skirt the material connecting the bearing *b* with the skirt portion c^1 may be reduced by providing wedgeshaped spaces *l* on each side of each of the two bosses. The wedge-shaped spaces may partly cut the bores b^3 of the bosses *b* so that oil grooves are formed.

Instead of metallic segments having smooth cylindrical surfaces and a single radial lug, as shown in Figs. 1, 2, 3, and 5 metallic segments can be used formed by undulated sheets and/or provided with several radial lugs. An undulated metal segment provided with two radial lugs is shown in Fig. 6 in plan view and vertical view.

My invention is not limited to the particular form of the piston described but may be variously modified without departing from the spirit and scope of my invention.

What I claim is:

A cast light metal piston for internal combustion engines comprising an upper head portion having a side wall adapted to carry piston rings, and a lower skirt portion having piston pin bosses, said head portion and said skirt portion being separated by a circumferentially extending air gap and being integrally connected together by opposed thick webs, in vertical alignment with said piston pin bosses, and opposed relatively thin webs intermediate said thick webs, all of said webs, depending from said head and being joined to said piston pin bosses, said thin webs being spaced inwardly from the side wall of said head, and a preformed metallic segment disposed in each of said thick webs, each of said segments having a lug extending inwardly therefrom and through a thick web, said metallic segments being spaced at least in part from the adjacent cast metal of the piston by spaces resulting from the shrinkage of said metal in cooling.

ERNST WALTER SCHNEIDER.