Dec. 17, 1935. K. F. WAGNER 2,024,958

LIGHT METAL PISTON

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Fig. 3

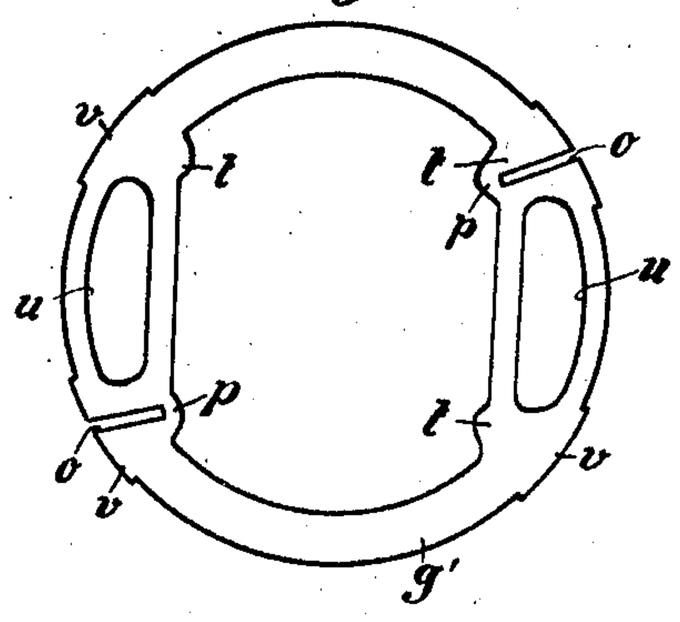


Fig. 1

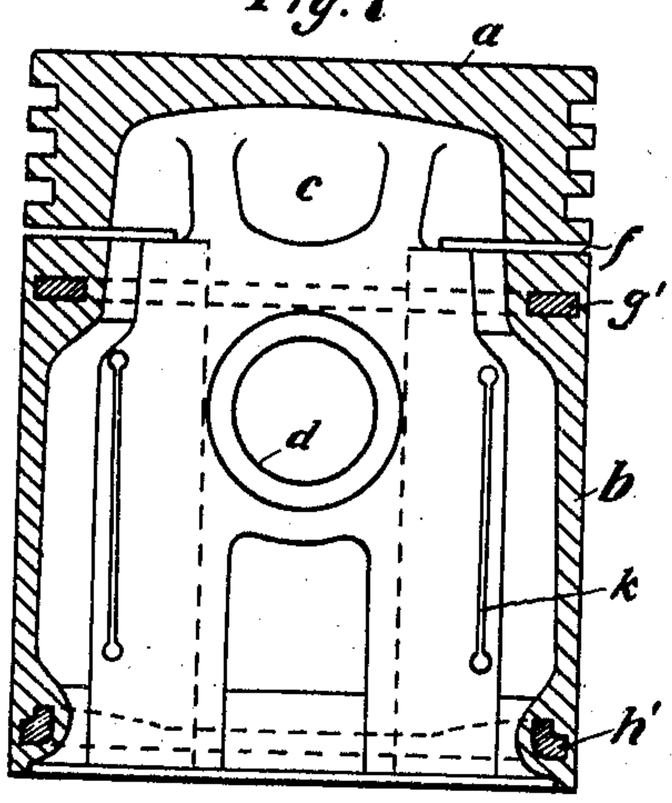
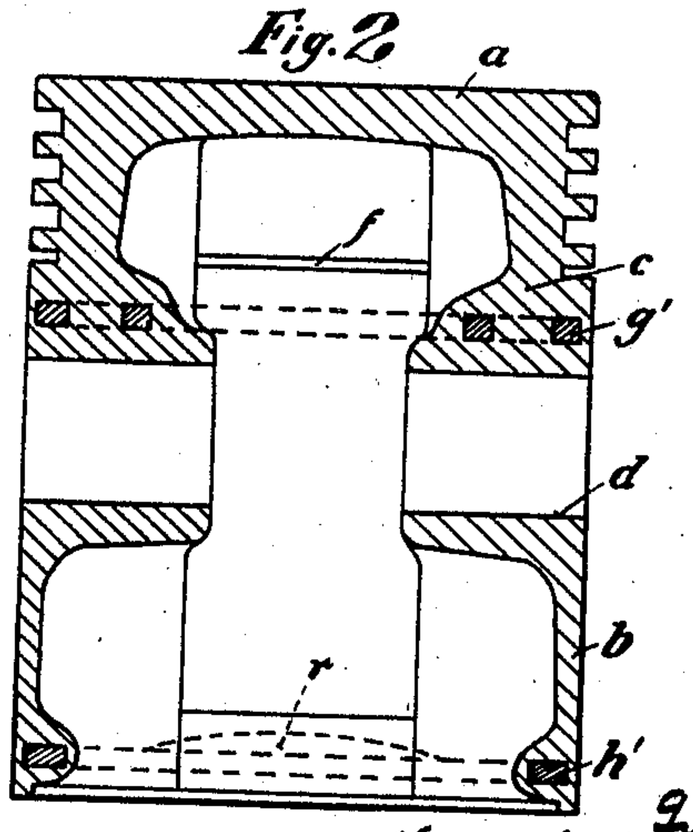


Fig. 2



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Fig. 4

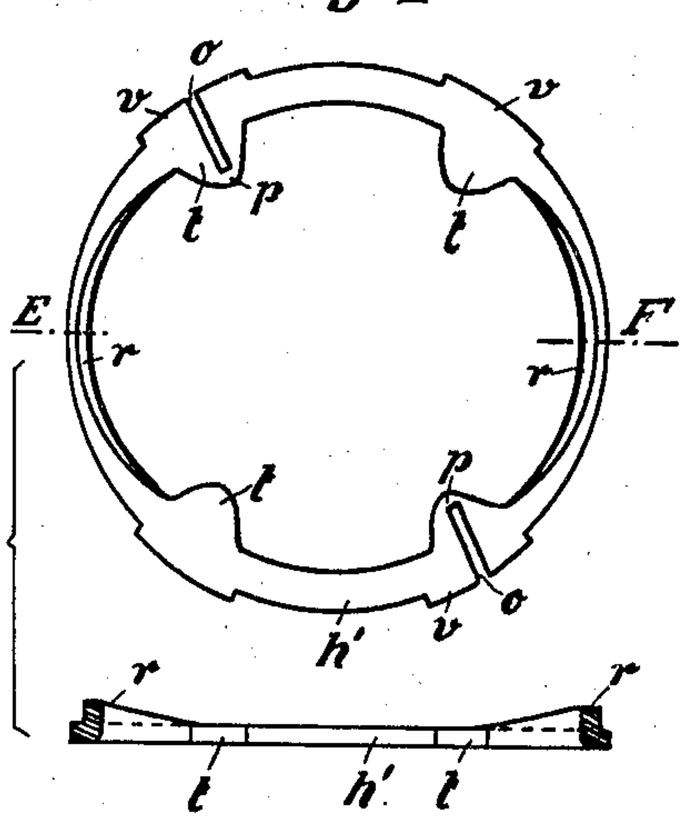


Fig. 5

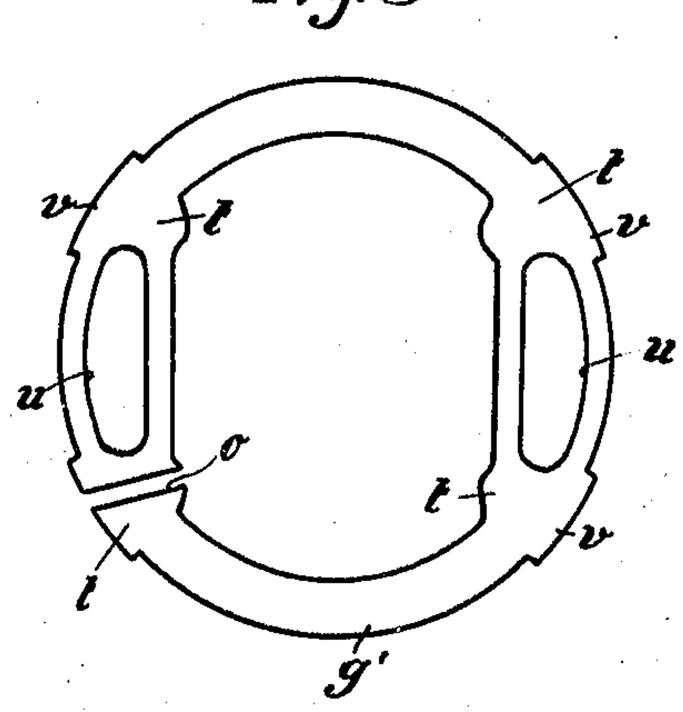


Fig. 6

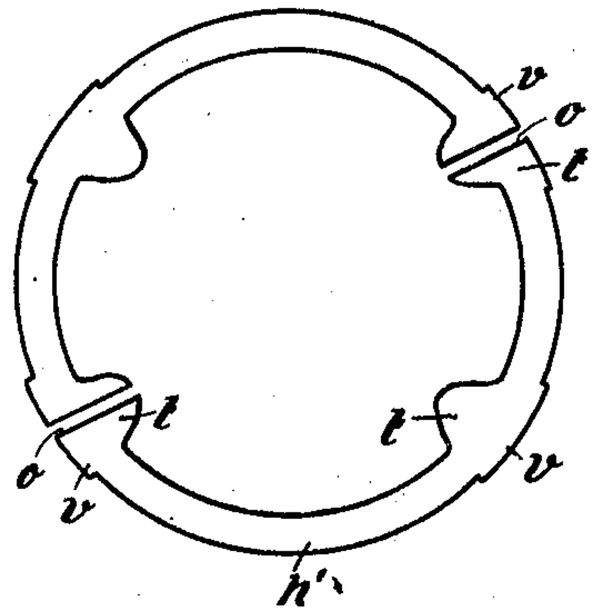
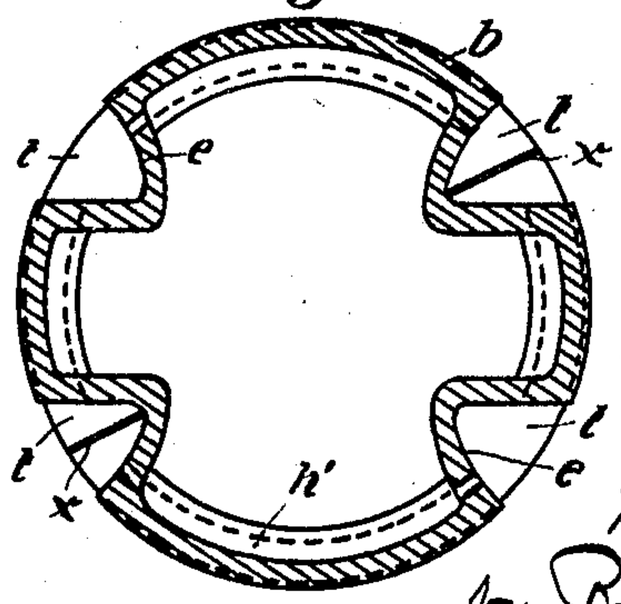


Fig. 7



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UNITED STATES PATENT OFFICE

2,024,958

LIGHT METAL PISTON

Karl Friedrich Wagner, Stuttgart, Germany

Application December 10, 1932, Serial No. 646,702
In Germany December 11, 1931

9 Claims. (Cl. 309—11)

The present invention relates to a light metal piston, consisting of alloys of aluminium or magnesium, more especially intended for internal combustion engines, having steel reinforcements embedded in the cast piston body.

The main object of my invention is to construct and arrange the steel reinforcements in such a way that the play between the piston skirt and the cylinder remains unaltered, or substantially unaltered, at all working temperatures throughout the length of the skirt of the piston, and the minimum play between the piston skirt and the cylinder can be kept particularly small. This is attained by applying to the piston skirt radial expansion controlling means of relatively freely expansible and contractible nature and by converting these means into the rigid closed ring form only after the cooling and the preliminary machining of the piston.

For this purpose the rings embedded in the cast piston body are made resilient by one or more splits extending partially through the rings, or there are provided one or more splits extending completely through the rings. After the cooling of the piston body the rings embedded therein are converted into the rigid form by closing the split or splits by welding. By the slotted or multipartite construction of the embedded steel rings, and consequently resilience or flexibility during the contraction, the rings adapt themselves to the contraction of the light metal piston upon cooling, and then after the welding are firmly embedded in the light metal without any play both in the cold as well as the in heated condition of the piston.

In order to compensate for the thermal expansion during heating of the piston skirt resulting from the movement of the steel rings embedded without any play in the light metal, the piston skirt is, according to the invention, formed so as to be resilient by the piston skirt having one or more longitudinal trough-shaped depressions or recesses having resilient walls. The expansion and contraction of the piston skirt takes place by this means not in the radial direction but in the peripheral direction of the piston skirt, the flexible walls of the trough-shaped depressions or recesses altering their form or position corresponding to the expansion or contraction. The resiliency of the walls of the trough-shaped depressions or recesses is facilitated by narrow longitudinal slits, which however are preferably provided only in those parts of the piston skirt situated between the steel rings.

Further features and advantages of the new light metal piston will be apparent from the drawings, in which

Figure 1 is a longitudinal section of the light metal piston transverse to the gudgeon pin bearing.

Figure 2 is a longitudinal section through the gudgeon pin bearing,

Figure 3 is a plan view of a form of construction of the steel ring adjacent to the gudgeon pin bearing having two slots which do not pass right through the ring before the incasting.

Figure 4 shows separately a form of construction of the steel ring adjacent to the open end of the piston in plan view and in section on the line E—F.

Figure 5 is a plan view of a steel ring similar to Figure 6 but having only one slot going through it.

Figure 6 shows a steel ring having two slots going through it.

Figure 7 is a cross section of a light metal piston having a steel ring corresponding to Figure 6.

In Figs. 1 and 2 the head *a* of the piston, which is made of an alloy of aluminium or magnesium, is connected with the skirt *b* simply by the webs *c* which carry the bearings *d* for the gudgeon pin, whilst the head and skirt in the remaining parts are separated from one another by the slots *f*. The piston skirt according to the invention has longitudinal trough-shaped depressions or recesses *e* which, in Fig. 7 illustrated, are provided at four places, and run from the open end of the piston past the gudgeon pin bearing *d* up to the slots *f*, which separate the head *a* from the skirt *b*. The walls *i* forming the recesses *e* may be made flat or even undulated. The expansion and contraction of the piston skirt *b* takes place in this case not radially to the cylinder axis, but in the peripheral direction, the walls *i* of the recesses *e* provided with longitudinal slots *k* altering their form and position correspondingly.

The steel rings *g'* and *h'* embedded in the cast light metal piston have one or more slots *o*, carried completely or partially through the ring, which, in the contraction process, enable the steel rings to contract to correspond with the contraction of the light metal skirt *b*, and thus ensure, a firm embedding of the steel rings in the light metal without any play. The slots *o*, the width of which is to be made to correspond to the magnitude of the contraction, are limited, according to Figures 3 and 4, by narrow webs *p*, which afford the steel rings sufficient cohesion and at the same time prevent liquid metal pene-

trating into the slots during the casting operation. The slot or slots *o* is, or are, formed, according to Figures 5 to 7, so as to go right through the ring, so that the steel rings consist, if desired, (Figure 6) of several completely separate parts. After the cooling of the casting and preliminary machining of the piston, the slots *o* are inseparably closed by welding or in other suitable manner, as indicated by the seams *x* in Figure 7.

The steel rings *g'* and *h'* are provided with inwardly projecting lugs or lobes *t*, and with extensions *v* projecting outwards to a certain extent, which lugs serve for the purpose of covering the recesses *e* which are provided in the piston skirt *b* concentric therewith for the purpose of expansion. The steel rings *g'* and *h'* lie, in the examples of construction shown in Figures 1, 2 and 7, completely within the light metal skirt *b* with the exception of the parts *t*.

In the substantially rectangular section steel rings shown in the drawings, their broad sides, according to the invention, are situated transversely to the working surface of the piston skirt. The steel ring *h'* adjacent to the open end of the piston has rectangular bends *r* on the inner side in the parts lying substantially parallel to the gudgeon pin bearing *d*, which serve to narrow the ring radially and to deepen the same so as to ensure sufficient clearance for the movement of the connecting rod, whilst the steel ring *g'* adjacent to the gudgeon pin bearing *d* is provided with enlargements at diametrically opposite places corresponding in direction to the bearing bosses, which enlargements contain openings *u* for the webs *c* connecting the head of the piston with the skirt *b*.

What is claimed is:

1. A light metal piston for internal combustion engines comprising a head part, a skirt part provided with longitudinal trough-shaped recesses, and rings embedded in the piston and of a metal having a coefficient of expansion less than that of the skirt part, the rings having inwardly directed lugs extending through the recesses of the skirt part.

2. A light metal piston for internal combustion engines comprising a head part, a skirt part having longitudinal trough-shaped recesses, and rings embedded in the piston and of a metal having a coefficient of expansion less than that of the metal of the skirt part, the rings having inwardly directed lugs extending through the recesses of the skirt part and outwardly directed extensions in the region of the lugs projecting up to the outward surface of the skirt part.

3. A light metal piston for internal combustion engines comprising a head part, a skirt and an expansion constricting ring embedded in the skirt and being of a metal having a coefficient of expansion less than that of the metal of the skirt, the radial cross-sectional dimension of the ring being greater than its axial dimension, said ring having enlargements at diametrically opposite places in alignment in an axial direction with the bearing bosses respectively, said enlargements being formed with openings for the webs connecting the head of the piston with the skirt.

4. A light metal piston for internal combustion engines comprising a cast metal body and an endless expansion constricting ring disposed in a plane substantially perpendicular to the axis of said body and embedded therein, said ring being free of internal stresses when the piston is cold, the coefficient of expansion of said ring being less than that of the cast metal of said body, and said ring being firmly bonded with the cast metal of said body so as to prevent relative movement between said ring and the rest of said body throughout all variations of heat conditions incident to the use of the piston.

5. A light metal piston for internal combustion engines comprising a cast metal body and an endless expansion constricting ring disposed in a plane substantially perpendicular to the axis of said body and embedded therein, said ring having slots adapted to partially close to accommodate contraction of the body during cooling thereof and being filled in by metal fused to the walls of the slots.

6. As an article of manufacture, an expansion constricting element for an internal combustion engine cast metal piston, said element consisting of a plurality of segments disposed in ring form and separated by slots, said slots being adapted to partially close to accommodate the contraction of the cast metal of the piston during cooling thereof and to be filled in in the cold state of said elements by metal fused to the walls of the respective slots to constitute a continuous unbroken expansion constricting ring.

7. As an article of manufacture, an expansion constricting element for an internal combustion engine cast metal piston, said element being adapted to be embedded in the body of the piston during the casting thereof and being of ring shape and formed with a slot adapted to partially close to accommodate the contraction of said piston body during cooling and being adapted to be filled in by metal fused to the walls of the slot to constitute a continuous unbroken expansion constricting element.

8. As an article of manufacture, an expansion constricting element for an internal combustion engine cast metal piston, said element being adapted to be embedded in the body of the piston during the casting thereof and being of approximate ring shape and formed with a plurality of slots adapted to partially close to accommodate the contraction of said piston body during cooling, said slots being adapted to be filled in by metal fused to the walls of the respective slots to constitute a continuous unbroken expansion constricting element.

9. As an article of manufacture, an expansion constricting element for an internal combustion engine cast metal piston, said element being adapted to be embedded in the body of the piston during the casting thereof and being of approximate ring shape and formed with a plurality of slots adapted to partially close to accommodate the contraction of said piston body during cooling, said element having integral yielding webs respectively extending across the radially inner ends of the respective slots to connect all parts of the element, and said slots being adapted to be filled in by metal fused to the walls of the respective slots after the cast metal piston body has cooled and contracted.

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