May 6, 1941. W. M. VENNER ET AL 2,240,968

PISTON

Filed July 3, 1940

Fig. 1.

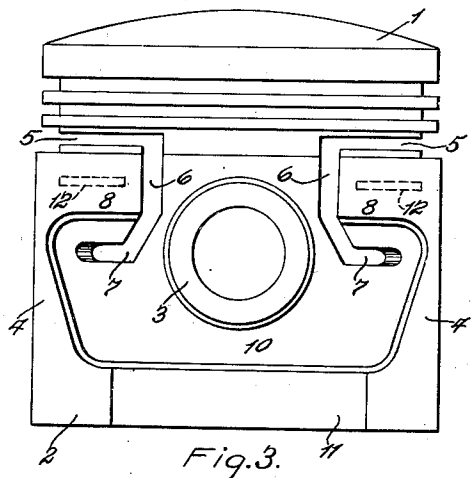


Fig. 2.

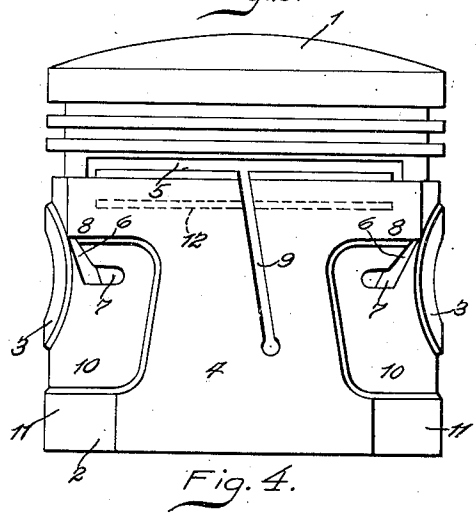


Fig. 3.

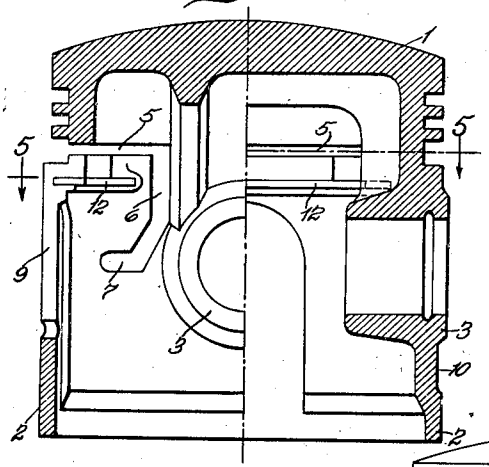


Fig. 4.

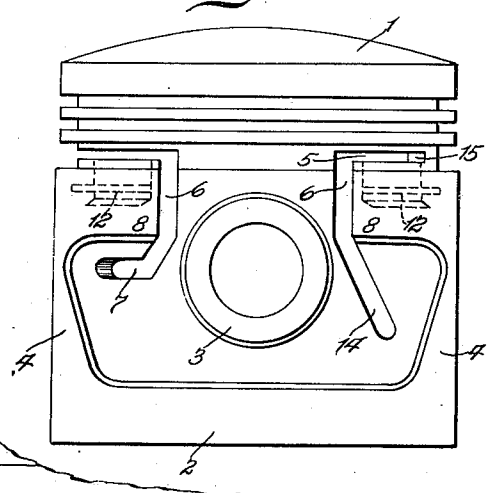
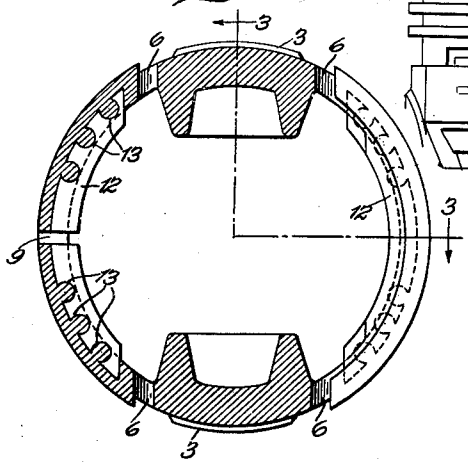


Fig. 5.



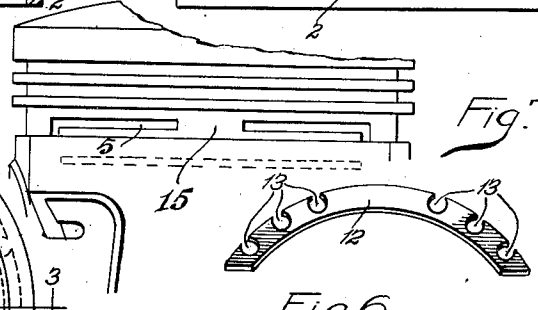


Fig. 7.

Fig. 6.

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UNITED STATES PATENT OFFICE

2,240,968

PISTON

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Application July 3, 1940, Serial No. 343,718

5 Claims. (Cl. 309—13)

This invention pertains to trunk pistons of the type used in automobile engines. More particularly, it pertains to such a piston when cast of light metal, such as aluminum or its alloys. This application is an improvement on application Serial No. 299,050, filed October 12, 1939.

One of the objects of this invention is to provide a piston with means whereby the high rate of thermal expansion of the piston metal may be compensated for by control means having a lower rate of expansion than the piston metal and incorporated with the casting.

Another object is to provide such a piston having control means cast into the upper portion of the skirt at the cylinder-bearing walls so as to control the curvature of said walls as the piston expands under rise of temperature.

Further objects will appear from the following description, taken in connection with the accompanying drawing, in which:

Figure 1 is a side view of a piston embodying this invention as seen along the wrist-pin axis.

Figure 2 is a similar view taken at right angles to that of Figure 1.

Figure 3 is a longitudinal section taken in two planes, as indicated by the line 3—3 of Figure 5.

Figure 4 is a view similar to Figure 1, illustrating another embodiment of this invention.

Figure 5 is a transverse section taken on line 5—5 of Figure 3, and

Figure 6 is a detail perspective view of one of the control elements.

Figure 7 is a partial side view of Figure 4.

Referring to the drawing, the piston illustrated is of the usual trunk type universally used in automotive engines and having a head 1 and a skirt indicated generally at 2. Depending from the head are wrist-pin bosses 3 having wrist-pin openings of the usual type.

The skirt is formed to provide cylinder-bearing portions 4 extending the full length of the skirt but separated from the head 1 by horizontally extending gaps 5 which cut entirely through the skirt so as to separate the same completely from the head at this point. The cylinder-bearing portions 4 are also separated from the pin bosses 3 along the upper portions thereof by slots or gaps 6 extending downwardly from the gaps 5. In the embodiment of Figures 1 and 2 the slots 6 bend at their lower ends so as to extend toward the middle of the cylinder-bearing portions 4, as indicated at 7. These curved slots thus form at the upper ends of the bearing portions 4 laterally extending wings 8, which are free of the head and the pin bosses, and thus may readily flex radially of the skirt.

One of the bearing portions 4 may be slotted by a vertically extending slot 9 extending downwardly from the gap 5. The slot 9 preferably terminates short of the bottom end of the skirt and usually about at the level of the lower portions of the pin bosses 3.

The regions of the outer surface of the skirt around the pin bosses 3 are preferably relieved by depressed areas 10. These areas are shown in the drawing as extending around the lower ends 7 of the slots 6. The lower rim of the skirt in the regions below the pin bosses may also be relieved slightly, as indicated at 11. The outer cylindrical surface of the bearing portions 4 may, if desired, be formed with a slightly elliptical eccentricity, whose minor axis extends along the wrist-pin axis in accordance with the usual practice.

It has been found that when a piston of this form expands in an engine cylinder the parts of the skirt which are subject to the greatest pressure against the cylinder wall, due to such expansion, are the upper side corners of the bearing portions 4. Accordingly, in order to relieve the pressure at these points and to control the curvature of the upper part of the portions 4, the piston is provided with control elements, seen in perspective in Figure 6. These are preferably constructed of some metal which has a lower rate of thermal expansion than the piston metal. Iron or steel provides a satisfactory material for a piston cast of the usual aluminum alloys. These elements 12 are mounted in the mold when the piston is cast and are thus cast into the piston structure, so as to extend horizontally along the upper edge of each bearing portion 4 just below the gap 5, as shown in Figures 1 and 2. The elements 12 may be provided with irregularities, such as the recesses 13, into which the casting metal may flow during casting so as to form a secure interlock between the casting and the elements 12. As will be seen from Figure 5, the elements 12 are so positioned as to lie inside of the curve of the bearing portion 4 and to form therewith a bi-metallic element, which acts thermostatically upon rise of temperature to increase the curvature of the upper ends of these bearing portions 4 to a slight extent. This increased curvature tends to draw the wings 8 radially inwardly by a slight flexure of this portion of the skirt, and thereby tends to counteract the growth of the piston at these upper corners of the bearing portions. It has been found that this action relieves

the excessive pressure at these upper corners and maintains a good fit of the piston in the cylinder bore.

On account of the variation in engine cylinders, due ordinarily to uneven expansion, it is advisable to slot one of the bearing portions so that the skirt may yield in case of excessive pressure due to such variation in the shape of the cylinder bore. Accordingly, the slot 9 is provided to avoid any increase in the stiffness of the portion of the skirt that might result from the addition of the element 12. This slot is usually cut by means of a saw after the piston has been cast, and in so doing the element 12 on that side is cut through so as to provide a pair of control elements, one on each side of the slot 9. Each of these elements acts to control its own side of the bearing portion 4 so as to control the curvature thereof and prevent undue expansion of the wing portions 8.

In the embodiment illustrated in Figure 4, the slot 6 on the side opposite to that in which the slot 9 is cut is extended downwardly toward the lower end of the skirt, indicated at 14, instead of horizontally, as in the other figures. This arrangement may be employed when it is desired to stiffen the part of the skirt which is controlled by the elements 12. The degree of flexibility may be varied somewhat by varying the position of this slot.

The skirt may be further supported on this same side by an integral bridge 15 across the gap 5, connecting the bearing portion on that side with the head 1. This bridge 15 is preferably made narrow so as not to interfere with the flexure of the skirt by the elements 12. This bridge is also preferably placed at the middle of the bearing portion 4 so as to provide for uniform flexure on both sides thereof.

It will be seen that this invention provides a piston which may be controlled closely as to its fit in the cylinder bore at all temperatures. Furthermore, the provision of the slot 9 in the bearing portion 4 renders the skirt yieldable under excessive pressure, while the provision of the pair of control elements on this side of the skirt controls the expansion of the wing portions 8 on this side as well as on the unslotted side.

It will be obvious that various changes may be made in the details of construction within the scope of the appended claims without departing from the spirit of this invention. It is understood, therefore, that the invention is not limited to the specific details shown and described.

The invention having thus been described, what is claimed is:

1. A light metal piston of the character described, comprising, a head, a skirt, wrist pin bearings connected with said head and said skirt, said skirt having a cylinder-engaging portion separated from said head and constructed to flex inwardly in the regions of said bearings, and an element having a rate of expansion lower than, extending circumferentially inside of and attached to, said cylinder-engaging portion, adapted to flex said portion inwardly in said regions thermostatically, said cylinder-engaging portion having a slot extending from the head toward the end of the skirt.

2. A light metal piston of the character described, comprising, a head, a skirt, wrist pin bearings connected with said head and said skirt, said skirt having a cylinder-engaging portion separated from said head and constructed to flex inwardly in the regions of said bearings, and an element having a rate of expansion lower than, extending circumferentially inside of and attached to, said cylinder-engaging portion, adapted to flex said portion inwardly in said regions thermostatically, said cylinder-engaging portion having a medial connection to said head.

3. A light metal piston of the character described, comprising, a head, a skirt, wrist pin bearings, connectors between said head and said skirt, said skirt having a cylinder-engaging portion separated from said head circumferentially and separated from said connectors terminally, constructed to flex inwardly in the regions of said bearings, and an element having a rate of expansion lower than said cylinder-engaging portion, said element extending circumferentially inside of and cast to said portion and terminating therewith, adapted to flex said portion inwardly in said regions thermostatically, said cylinder-engaging portion having a slot extending from the head toward the end of the skirt.

4. A light metal piston of the character described, comprising, a head, a skirt, wrist pin bearings connected with said head and said skirt, said skirt having cylinder-engaging portions separated from said head and constructed to flex inwardly in the regions of said bearings, and an element extending circumferentially inside of and attached to each of said cylinder-engaging portions, said element having a rate of expansion lower than that of said portion and adapted to flex said portion inwardly in said regions thermostatically, one of said cylinder-engaging portions having a slot extending from the head towards the end of the skirt.

5. A light metal piston of the character described, comprising, a head, a skirt, wrist pin bearings, connectors between said head and said skirt, said skirt having cylinder-engaging portions separated from said head circumferentially and separated from said connectors terminally, constructed to flex inwardly in the regions of said bearings, and elements having a rate of expansion lower than that of said cylinder-engaging portions, one of said elements extending circumferentially inside of and cast to each of said portions and terminating therewith, adapted to flex each said portion inwardly in said regions thermostatically, one of said cylinder-engaging portions having a slot extending from the head toward the end of the skirt.

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