Sept. 2, 1947. E. M. GATES 2,426,732

PISTON

Filed May 28, 1945 2 Sheets-Sheet 1

FIG. 1.

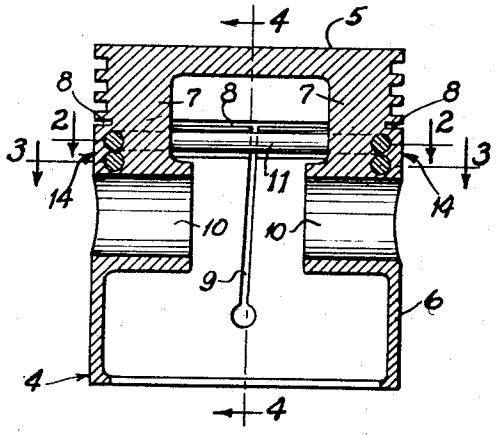


FIG. 4.

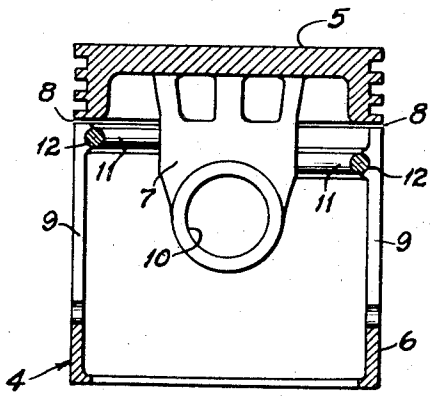


FIG. 2.

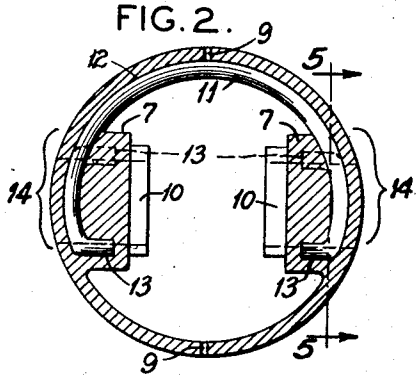


FIG. 5.

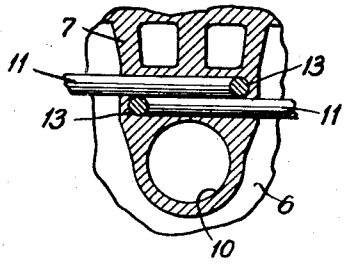


FIG. 3.

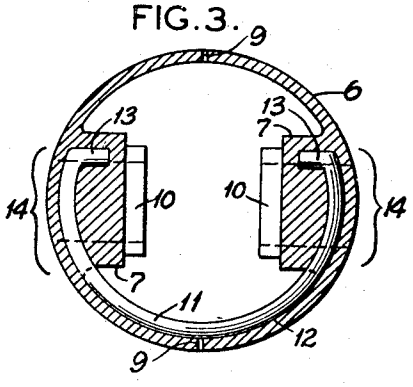
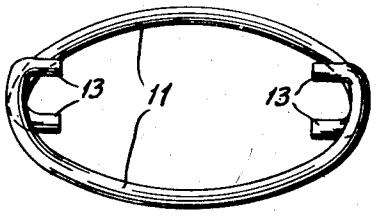


FIG. 6.



INVENTOR.
EDWARD MONT GATES
BY
Alfred W. Peterhoff
ATTORNEY

Sept. 2, 1947. E. M. GATES 2,426,732

PISTON

Filed May 28, 1945 2 Sheets-Sheet 2

FIG. 7.

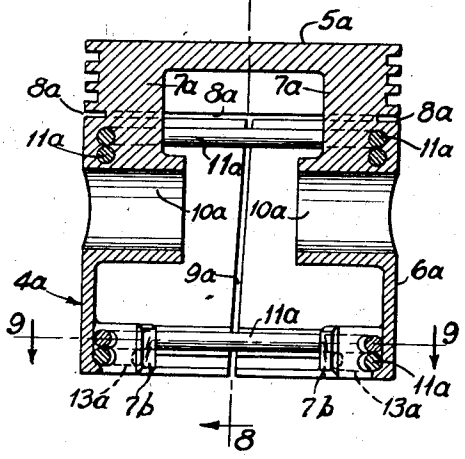


FIG. 8.

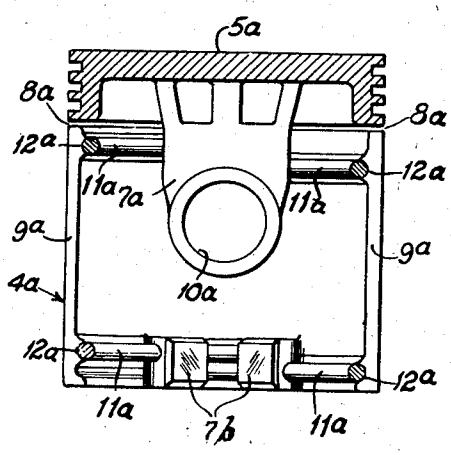
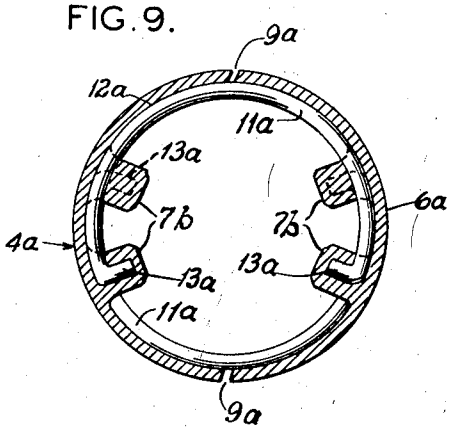


FIG. 9.



INVENTOR.
EDWARD MONT GATES
BY
ATTORNEY

Patented Sept. 2, 1947

2,426,732

UNITED STATES PATENT OFFICE

2,426,732

PISTON

Edward Mont Gates, St. Louis, Mo.

Application May 28, 1945, Serial No. 596,266

10 Claims. (Cl. 309—13)

1

My invention relates to pistons, and more particularly to pistons for internal combustion engines, and has for its principal object the provision of an improved piston of this character in which means are provided for controlling the clearance between the piston skirt and cylinder walls having different coefficient of thermal expansion.

A further object is to relieve piston skirt pressure towards the cylinder walls, thus decreasing wear, scoring and fuel consumption, this result being accomplished through the varying coefficient of thermal expansion of the parts involved, and their arrangement and mode of assembly within the piston.

Another object of the invention is to provide means, incorporated and mounted within the skirt of a piston of the kind referred to and supported from the pillars which are extensions toward the crown of the pin bosses thereof, for controlling under varying temperatures the circumference of the piston skirt relative to the expansibility of the cylinder walls, and thus maintain the desired amount of clearance between the piston skirt and the cylinder walls, the said means including a pair of equalizing links semi-circular in form and of substantially less coefficient of thermal expansion than that of the piston itself, and molded or cast or otherwise mounted circumferentially within the piston and supported in place from the pillars thereof or from separate lugs on the piston skirt below the pillars, the said links being disposed at opposite sides of the piston skirt.

With the stated objects in view, together with such other and additional objects and advantages as may appear from the following specification, attention is directed to the accompanying drawing as exemplifying preferred structural features and embodiments of the invention and wherein:

Figure 1 is a longitudinal or vertical diametrical section through a piston of the kind referred to, and wherein is incorporated or mounted the semi-circular equalizing links referred to, the same being supported at their ends in the pillars of the piston and disposed within grooves on the opposite sides of the piston skirt, below the head thereof.

Figure 2 is a cross section on the line **2—2** of Figure 1.

Figure 3 is a cross section on the line **3—3** of Figure 1.

Figure 4 is a longitudinal or vertical diametrical section taken at right angles to the view of Figure 1, on the line **4—4** of Figure 1.

2

Figure 5 is a sectional detail on the line **5—5** of Figure 2, and which shows structure constituting an essential element of the invention.

Figure 6 is a perspective view of a pair of overlapped equalizing links for mounting within the skirt of the piston at either top or bottom thereof or both, and supported at their ends within the pillars of the piston or within separate lugs on the piston skirt below the said pillars, and extended circumferentially around opposite sides of the piston skirt.

Figure 7 is a view similar to that of Figure 1, showing the equalizing links as mounted within the lower portion of the piston skirt as well as within the top portion of the skirt as shown in Figures 1 to 5.

Figure 8 is a longitudinal or vertical diametrical section on the line **8—8** of Figure 7.

Figure 9 is a cross section on the line **9—9** of Figure 7.

This invention is designed for mounting within conventional forms of internal combustion engine pistons, such as represented generally at **4** and **4a** in the drawing in Figures 1 and 7, and which include a piston head **5** or **5a**, a piston skirt **6** or **6a** connected with the head portion by means of oppositely disposed pillars **7** or **7a**, the head and skirt portions being separated and slightly spaced apart by circumferential slots or partings **8** or **8a**, which slots or partings permit of the expansion or contraction of the head portion independently of the skirt portion. Additionally the skirt portion of the piston is also longitudinally slotted as shown at **9** or **9a** of Figures 1 and 7, along diametrically opposite lines on the skirt portion, intermediately of the said pillars and somewhat angularly relative to the longitudinal lines of the skirt, and either terminating short of the lower edge of the skirt as shown in Figure 1, or else extending clear out through the lower edge of the skirt, as shown in Figure 7. The lower ends of the pillars **7** or **7a** are formed as cylindrical bearings **10** or **10a**, for the crank-pin (not here shown).

However and due to the fact that the cylinders of internal combustion engines are generally cast of iron or steel having a certain rate, degree or coefficient of thermal expansibility, while the pistons are generally cast of some much lighter metal, such as aluminum or magnesium, having a considerably higher rate, degree or coefficient of thermal expansibility, the result is that under the heat of combustion of fuel as generated by the engine in operation, and in spite of the slots of the piston skirt which allow for and accommodate to a degree for the variations in the co-

efficients of thermal expansibility of these elements, the piston and the skirt thereof expand faster and to a greater extent than the walls of the cylinder, and pressing heavily against these walls, cause frictional scoring of both the piston skirt and cylinder walls, causing damage to these elements and wastage of fuel due to the frictional drag of the piston.

In accordance with this invention therefore, additional means are provided and mounted within the skirt of the piston for equalizing, regulating and adjusting the normally greater thermal expansibility of the piston as compared with the lower expansibility of the cylinder walls. As shown in Figures 1 to 5 the means as provided for this purpose comprise a pair of semi-circular equalizing links 11, of substantially less coefficient of thermal expansibility than that of the piston itself, and anchored at their ends within the opposite margins of the pillars 7 by molding or casting ends in place, the intermediate portions of the links being additionally supported in grooves 12 formed around the inner walls of the piston skirt and on opposite sides thereof immediately below the head 5 of the piston, and with their medial portions spanning the parting slots 9, the said links being seated at their ends within the pillars one above the other in overlapping relation, with their ends turned inwardly at right angles at opposite distal margins of the pillars, as clearly indicated at 13 in Figures 2, 3 and 5. After the described casting operation as stated, a slight "peening" operation on the external sides of the skirt immediately at the pillars, as indicated at 14 in Figures 1, 2 and 3, will suffice to free the curved portions of the links as housed within the pillars from any cohesion to the encircling portions of the pillars, thus permitting the free movement and expansion or contraction of the curved portions of the links within the pillars for moving and operating the links in opposite directions for expanding and contracting the skirt of the piston, thus equalizing and adjusting the minimum and maximum thrust faces of the skirt and by which arrangement the piston skirt as a whole is retarded or expanded contrariwise to its normal tendency under the heat of fuel combustion and conformably with the normal expansion of the cylinder walls. While as stated, the inturned ends of the equalizing links are anchored within the pillars by a molding or casting operation in a conventional manner, this anchorage may be made and effected in any other conventional manner. And it is to be noted that while these links 11 are entered into the pillars 7 through one margin thereof, the inturned ends of the links are anchored into the opposite margins of the pillars in an overlapped relation, with the result that due to the relative greater expansibility of the pillars in a transverse direction as compared with the lesser expansibility of the links themselves, the lateral expansion of the pillars will add to and facilitate and accentuate the equalizing action of the said links 11 in operation.

In this way the desired amount or degree of expansion or contraction of the elements is regulated and controlled by virtue of the varying coefficients of thermal expansibility of the materials of the pillars and the equalizing links in co-operation with the spacing of the overlapped ends of the said links.

The structure as above described relates to the partially slotted form of piston skirt, as shown in Figures 1 to 5. Where the piston skirt is slotted or parted clear down through its lower margin at each side, as shown at 9a in Figures 7 to 9, the upper equalizing links 11 and connections may be retained, and then an additional pair of semicircular equalizing links 11a may be mounted circumferentially within grooves 12a formed around the inner sides of the skirt 6a, at the bottom of the skirt and across the slots 9a, and anchored at their inturned ends in circumferentially spaced bearings lugs 7b, as indicated at 13a, whereby additional equalizing means are provided at the lower end of the piston for conforming the expansion thereof within the cylinder walls, in co-operation with the equalizing links at the upper end of the piston.

While the equalizing links 11 and 11a as here shown are round in cross section, it is obvious that same might be made in the form of flat semicircular strips or plates, with mounting apertures of the pillars and bearing lugs correspondingly formed to receive the ends thereof.

It is thought that the construction and use of the equalizing links as mounted or incorporated within pistons of the kind referred to, will be fully understood from the foregoing description, the links at one side of the skirt controlling the minimum thrust side of the piston, while the links at the opposite side control the maximum thrust side thereof, and while I have here shown and described certain preferred forms and structures of my invention, it is understood that the structural features as shown may be changed or modified as desired, within the scope of the claims.

What I claim as novel and desire to secure by Letters Patents is:

1. A piston having a skirt, pillar portions having angular recesses therein, and means disposed within the skirt and anchored at its ends in the recesses, said means having a different coefficient of thermal expansion than that of the piston for respectively increasing and decreasing a portion of the skirt circumference upon cooling and heating of the piston.

2. In a piston of the character described, pillar portions having a relatively high coefficient of thermal expansion and formed with recesses therein adapted to receive and anchor, accommodate and support other means having a lesser coefficient of thermal expansion, the said latter means comprising links passed freely within said recesses in over-lapped relation at their ends, and the extremities of the ends being inturned into the recesses for anchoring the same therein, the said links having a lesser coefficient of thermal expansion than the pillar portions, for increasing and decreasing a portion of the skirt circumference.

3. A piston including a head portion, a skirt portion, pillars at opposite sides of the skirt portion for connecting the same with the head portion, and means disposed for free-sliding movement within the skirt and anchored at its ends in the pillars, said means having a different coefficient of expansion than the pillars for equalizing and conforming the thermal expansibility of the skirt portion with walls of a cylinder wherein the piston is mounted.

4. A piston including a head portion, a skirt portion, pillars at opposite sides of the skirt portion, and equalizing links disposed for free-sliding movement within the skirt and anchored at its ends in the pillars, said links having a different coefficient of thermal expansion than the pillars for equalizing and conforming the thermal expansibility of the skirt portion with the

walls of a cylinder wherein the piston is mounted.

5. A piston for operative disposition within the cylinder of an internal combustion engine, the said piston including a head portion, a longitudinally slotted skirt portion, pillars at opposite sides of the skirt portion for connecting same with the head portion, and means disposed for free-sliding movement within the skirt and anchored at its ends in the pillars, said means having a different coefficient of thermal expansion than said pillars for conforming the thermal expansibility of the skirt portion with the walls of the cylinder.

6. In an engine piston of the kind described as mounted within its cylinder, the said piston including a head portion, a skirt portion longitudinally slotted along opposite sides, and pillars at opposite sides of the skirt portion connected with the head portion, semi-circular equalizing links having a different coefficient of thermal expansion than the pillars and skirt and cylinder walls, circumferentially mounted within the skirt portion and anchored at their ends within the said pillars with their ends overlapped within the pillars, as means for conforming the thermal expansibility of the skirt portion with the cylinder walls.

7. A piston including a head portion, a skirt portion, pillars at opposite sides of the skirt portion, semi-circular links circumferentially connecting the pillars inside the skirt portion, said links being freely supported within grooves formed around the inner sides of the skirt portion and being anchored at their ends within the pillars in overlapped relation, at opposite margins of the pillars, except for their anchored ends the links being free to expand or contract within said pillars, said links being of lesser coefficient of thermal expansibility than the pillars, whereby due to the greater transverse expansibility of the pillars the lateral expansion of the pillars under the heat of combustion, the said links will equalize the expansion of the skirt portion conformably with the expansion of the cylinder walls of the cylinder within which the piston is mounted.

8. In a piston of the character described and including head and skirt portions and pillars at opposite sides of the skirt portion, semi-circular equalizing links circumferentially connecting the pillars inside the skirt portion, the ends of the links being passed freely into the pillars from opposite sides thereof in overlapped relation and anchored at their inturned extremities in the opposite margins of the pillars, said links being of different coefficient of thermal expansibility than the pillars, for increasing and decreasing the piston skirt under the heat of combustion.

9. In a piston of the character described and including head and skirt portions, semicircular equalizing links for circumferentially mounting within the skirt of the piston, said links being of different coefficient of thermal expansion than the skirt portion and being anchored at their ends to the skirt portion with said ends arranged in overlapped relation, for controlling the expansibility of the skirt portion under the heat of combustion.

10. In a piston of the character described and including head and skirt portions, a pair of semicircular equalizing links for circumferentially mounting within the skirt of the piston with the ends of the links positioned in overlapped relation and anchored at their inturned extremities to the skirt portion, said links being of different coefficient of thermal expansion than the skirt of the piston for controlling the expansibility of the latter under the heat of combustion.

EDWARD MONT GATES.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,532,121	Butler	Apr. 7, 1925
2,221,535	Berry	Nov. 12, 1940
2,086,677	Nelson	July 13, 1937
2,262,132	Berry	Nov. 11, 1941
2,373,493	Nicolle	Apr. 10, 1945
2,373,518	Townhill	Apr. 10, 1945