Jan. 4, 1927. 1,613,410

C. L. POST

PISTON RING

Filed Oct. 14, 1922 2 Sheets-Sheet 1

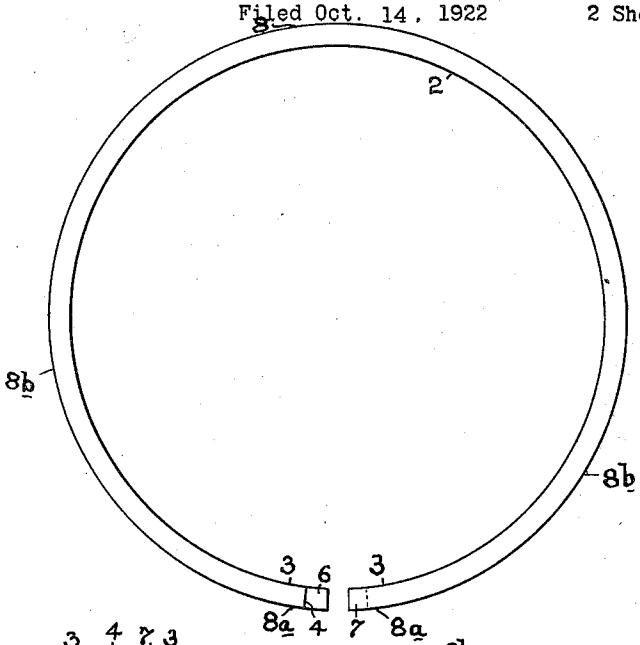


FIG. 1

FIG. 3

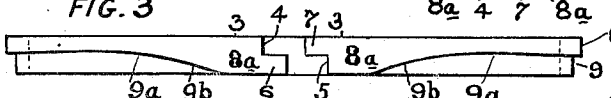
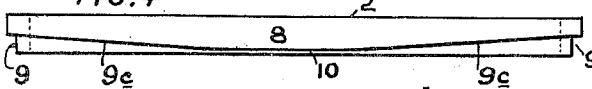


FIG. 4



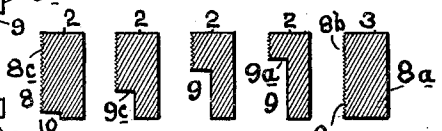


FIG. 6 FIG. 7 FIG. 8 FIG. 9 FIG. 10

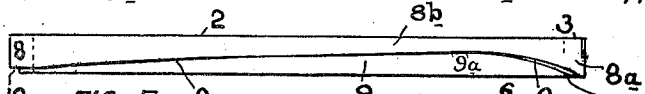


FIG. 5

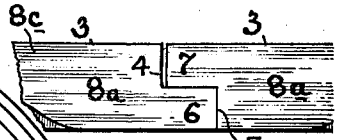
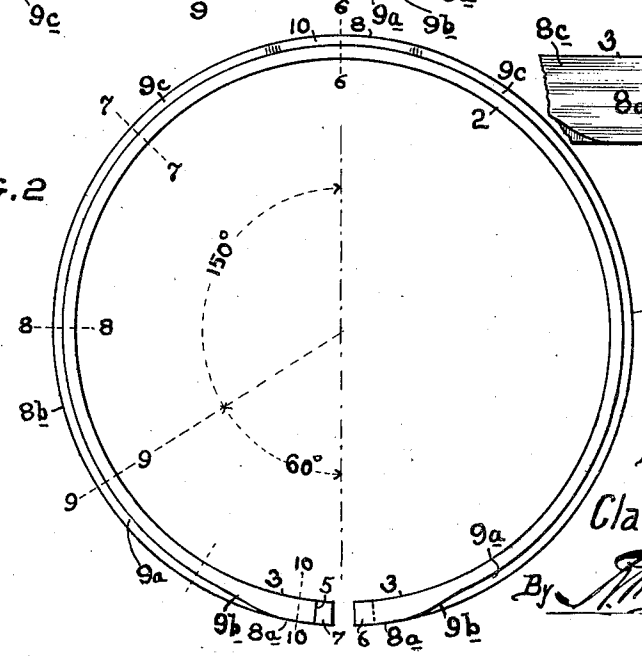


FIG. 11

FIG. 2



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PISTON RING

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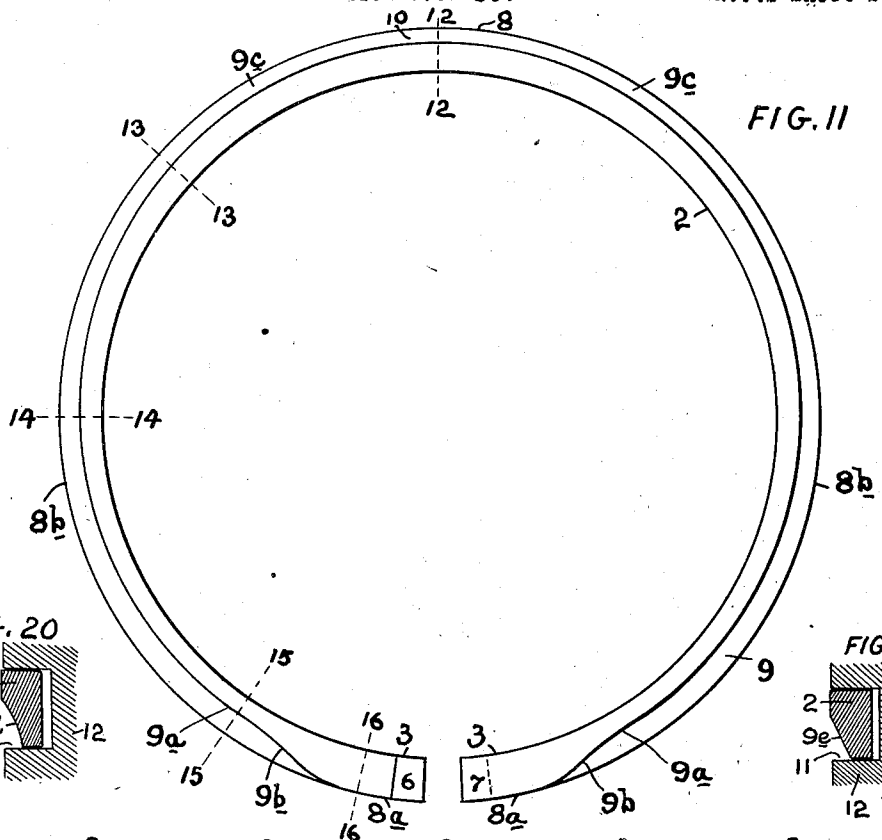


FIG. 11

FIG. 20

FIG. 21

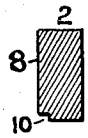


FIG. 12

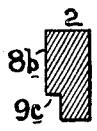


FIG. 13

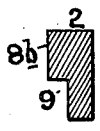


FIG. 14

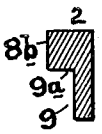


FIG. 15

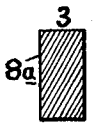


FIG. 16

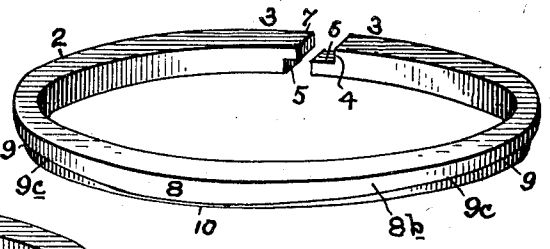


FIG. 18

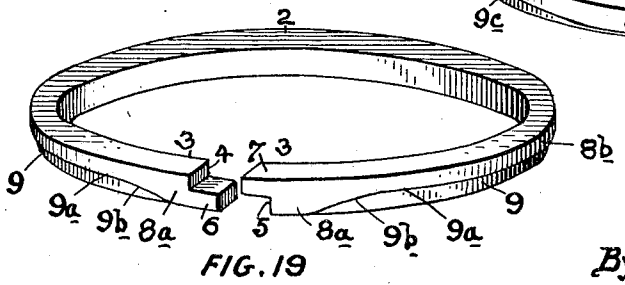


FIG. 19

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Patented Jan. 4, 1927. 1,613,410

UNITED STATES PATENT OFFICE.

CLAUDE L. POST, OF PHILADELPHIA, PENNSYLVANIA.

PISTON RING.

Application filed October 14, 1922. Serial No. 594,461.

My invention has for its object the construction of a piston ring suitable for explosive and other engines and having a construction especially adapted for insuring immediate accurate fitting of the cylinder bore and further provided about its perimeter adjacent to the bottom end with a groove adapted for controlling the degree of elasticity of the ring circumferentially and radially considered, and also providing reservoir space for receiving the oil required for the lubrication during the reciprocation of the piston.

My invention more specifically comprises an expansible one-piece split piston ring having the greatest cross sectional area arranged immediately adjacent to the split or toe ends and also in that portion or heel of the ring diametrically opposite the said split portion, and the cross section reduced intermediate of the said parts by a grooved outer perimeter open to one edge of the ring and so shaped as to give to the ring a gradual varying cross sectional area between the toe portions and the heel portion, said varying cross sectional area preferably decreasing gradually along the sides from the toe ends and the body or heel of the ring diametrically opposite and having the smallest cross sectional area nearer to the toe ends than to the heel portion of the ring diametrically opposite.

The invention further comprises the foregoing construction wherein the grooved reservoir portions at each side of the ring between the portions of greatest cross sectional area are united by a very shallow groove in the heel portion to permit oil to pass circumferentially from one reservoir groove to the other and vice versa, to equalize the oil supply.

My invention further comprises a split one-piece expansible piston ring having its perimeter turned with a series of exceedingly fine grooves forming slight circumferential ridges, said ring being turned when fully compressed, whereby it is accurately of circular construction in its operative condition and presents exceedingly fine ridges about its circumference which permit the ring to seat itself quickly and accurately assume a condition of perfectly fitting the bore of the cylinder when the same is slightly out of round.

My object is further to provide the piston ring with a varying width of contact against the cylinder wall, whereby the greatest possible bearing surface is provided where the greatest wear occurs and said surface tapering off to the least bearing surface where the least wear occurs, thereby giving to the ring the combined advantages of both the eccentric and concentric types of rings.

My object is further to provide a split ring with its ends rabbeted to provide overlapping projections on the step portions, one of which overlapping portions is slightly longer than the other, whereby it becomes necessary to file only the end of one of these step portions to enable the ring to accurately fit the cylinder bore without a material gap and permitting the fitting to be accomplished in a speedy and easy manner.

With the above and other objects in view, the nature of which will be more fully understood from the description hereinafter, the invention consists in the novel construction of piston ring, as hereinafter more fully described and defined in the claims.

Referring to the drawings: Figs. 1 and 2 are plan views of the top and bottom of my improved piston ring before compression; Fig. 3 is an edge elevation of the ring looking at the side where it is split; Fig. 4 is a similar view looking at the side diametrically opposite to the split; Fig. 5 is a similar view of the ring from the position at right angles to the position shown in Figs. 3 and 4; Figs. 6, 7, 8, 9 and 10 are cross sections taken respectively on the dotted lines 6—6, 7—7, 8—8, 9—9 and 10—10 of Fig. 2; Fig. 11 is an inverted plan view, corresponding to Fig. 2, of my improved piston ring showing the groove variable in depth in a radial direction; Figs. 12, 13, 14, 15 and 16 are cross sections of the same taken respectively on dotted lines 12—12, 13—13, 14—14, 15—15 and 16—16 of Fig. 11; Fig. 17 is an elevation of the middle portion of Fig. 3, when the piston ring is compressed to close the gap; Figs. 18 and 19 are perspective views of my improved piston ring; and Figs. 20 and 21 are cross sections illustrating modifications.

2 is the body of the ring and normally, as shown in the drawings, it is of greater diameter than that which it assumes when in operation in the cylinder. A portion of this ring is cut away to form a split and gap in its circumference and providing thereat free or toe ends 3, 3, which are so shaped as to have rabbets 4 and 5 presenting projecting

portions 6 and 7, respectively. When the ring is compressed, these projecting portions 6 and 7 overlap each other in close juxtaposition, as indicated in Fig. 17, and, moreover, the lengths of these parts 6 and 7 are different so that one of them, as 6 alone, contacts with the rabbeted portion of the other ring end, as will be clearly understood from Fig. 17, wherein the parts 5 and 6 are in close contact while there is provided between the parts 4 and 7 a slight space or gap. By making the projecting portions 6 and 7 of different lengths, it then only becomes necessary in fitting the ring to the piston to file one of the projecting portions alone and thereby save time and labor.

When the ring is compressed to approximately the working diameter, it is then turned in a lathe so as to have its peripheral surface formed as a true circle and, moreover, the peripheral surface is turned with a series of exceedingly fine grooves presenting radial projecting circumferential ribs 8^c (Figs. 6 to 10, inclusive) to enable the ring to seat itself quickly to a cylinder that is slightly out of round.

As shown in the drawings, the heel portion 8 has a vertical bearing surface of approximately the full height of the ring and, similarly, the toe portions 3, 3, have full vertical bearing surfaces 8^a, these portions being those which experience has shown receives the greatest amount of wear. Between the heel and toe portions on each side of the ring, the metal at the lower portion 9^a is cut away to form a groove 9, said groove extending to the bottom of the ring and bounded at the upper portion by a shoulder 9^b, the said shouldered portion being arranged circumferentially along its length at different distances from the bottom of the ring so that the groove is of variable vertical height, and by reason thereof, forming the circumferential bearing surface of the ring of variable vertical height, said height being inversely proportional to the vertical height of the groove. As shown, the greatest vertical height of the groove and the minimum height of the bearing surface occurs at a position 9—9 of the grooved portion between 8^b and 9^a which is preferably approximately 60° from the toe ends or split portion of the ring and from this position the said shouldered portion 9^b of the groove slopes gradually downward toward the toe ends and toward the heel portion of the ring, as will be readily understood from reference to Figs. 3, 4 and 5. This construction gives a variable cross sectional area along the sides of the ring from the heel to the toe ends. A number of cross sections about the ring, taken at the lines 6—6, 7—7, 8—8, 9—9 and 10—10, are shown respectively in Figs. 6 to 10, inclusive.

From Fig. 9, it will be seen that the cross sectional area of the ring is a minimum and this minimum is approximately 60° from the toe ends, though I do not limit myself to this particular position for the smallest cross section of the ring. These weakened portions of the sides of the ring adjacent to the parts 9^a act as parts of greatest flexibility, than they would otherwise have, so as to reduce to a material extent the severe wear which ordinarily comes upon the surfaces 8^a thereof. Moreover, by gradual reducing, the cross sectional area from the heel up to the points 9^a, the result is to gradually increase the radial flexibility to permit the ring to assume the cylindrical shape when compressed to a smaller diameter with all the advantages of the eccentrically bored type of ring, so that this advantage is secured with the additional advantage of providing the toe portion with a gradually increasing cross sectional area to provide the necessary bearing and at the same time permit the proper cooperation of the said toe ends to close the gap in the ring and without excessive wear at this portion.

Referring now to Figs. 11 to 16, inclusive, the piston ring is, in general, formed the same as in the construction illustrated in Figs. 1 to 10, inclusive, but in which further the radial depth of the groove 9 is varied so that the inner wall bounding the groove is of least radial thickness adjacent to the heel portion 8 and toe portions 3, 3, and of greatest radial depth approximately at 9^a, preferably in this case about 30° from the split between the toe ends, and corresponding to the place of least contact of the outer peripheral bearing surface of the ring. The cross sectional area shown in Fig. 15 of the ring shown in Fig. 11 corresponds to the cross sectional area of Fig. 9 of the ring shown in Figs. 1 and 2, with the exception that the radial depth of the groove 9 is greater in the case of Fig. 15 than in the case of Fig. 9. The result of this is that greater flexibility is provided for equal sizes of the ring, but it also provides capacity for maintaining equal flexibilities with an increased peripheral bearing surface. For more convenient comparison, it is pointed out that Figs. 11 to 16 correspond to Figs. 2, 6, 7, 8, 9 and 10, except as to the variable radial depth of the groove 9 in the former, the cross sections of the ring in Figs. 12 to 16, inclusive, corresponding in positions to the cross sections of Figs. 6 to 10.

In the use of my improved ring, the edges 9^a, 9^b and 9^c, constitute oil scraping edges for collecting the oil on the suction stroke and carry it to the lowest point of the ring travel deposit or distributing the oil against the cylinder wall on the next upward stroke, the capacity of the reservoirs formed by the grooves 9 being sufficient to hold all the oil required for this purpose. It will also be

understood that the varying depth of the outer circumferential portion of the ring, taken in connection with the turned fine rigged faces, enables a quick seating of the ring to the shape of the cylinder bore, and the provision of the full vertical face of the ring at the heel and toe portions insures long life and efficiency. This improved ring in providing a varying width of contact against the cylinder wall gives it the greatest possible bearing where the greatest wear occurs and tapering off in its area of contact to the least bearing where the least wear arises, thereby giving to the ring the combined advantages of both the eccentric and the concentric types of rings.

While I have described my invention in considerable exactitude in respect to the more preferred construction, particularly with respect to the shape of the grooves, I desire to state, however that I do not confine myself to the groove which is formed wi h abrupt or right angled walls, as the groove or the part constituting the equivalent thereof when the ring is in use may be of various shapes in cross section such, for example, as shown in Figs. 20 and 21, from which it will be seen that in Fig. 20, the groove is formed of a curved wall 9^d instead of the right angled walls indicated in Figs. 6 to 9, inclusive. Similarly, in Fig. 21, the bevel 9^e provides the undercut portion constituting the groove. In this figure I have indicated the piston 12 with a groove 11 for the piston ring. In practice, there would be a number of rings used in connection with a single piston, and these rings may be all applied with their grooves directed to one end of the piston or part directed to one end and part to the other end, as preferred.

It will also be understood that, if desired, part of the rings may have the more abrupt shouldered grooves of Figs. 7 to 9 and 13 to 15, inclusive, providing a maximum space within the outer confines of the piston to constitute oil grooves, nevertheless, the modified form of Figs. 20 and 21 provide oil spaces in the piston grooves which are amply sufficient in some cases and especially where the said rings are employed in association with the rings having the more abrupt grooves. It will be understood, therefore, that when I refer to "grooves" in connection with the ring either in the specification or claims, I am employing the said term in a relatively broad sense to include all the possible variations in the grooved portions such as illustrated in various figures of the drawings, including Figs. 20 and 21.

It will now be apparent that I have devised a novel and useful construction which embodies the features of advantage enumerated as desirable, and while I have in the present instance shown and described the preferred embodiment thereof which has been found in practice to give satisfactory and reliable results, it is to be understood that I do not restrict myself to the details, as the same are susceptible of modification in various particulars without departing from the spirit or scope of the invention.

Having now described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. A one-piece split expansible piston ring having an outer maximum bearing surface adjacent to the split ends and on the body diametrically opposite thereto, and having further the circumferential portions of the ring intermediate of the said maximum bearing surface portions with a grooved construction wherein the groove extends to the perimeter and also to the end face of the ring to remove the main portion at one annular corner and said grooved construction comprising two grooves extending respectively between the maximum bearing surfaces and on diametrically opposite portions of the ring, said grooves having gradual decreasing cross sections in the direction from the split end of the ring toward the maximum bearing surface diametrically opposite thereto.

2. A one-piece split expansible piston ring having an outer maximum bearing surface adjacent to the split ends and on the body diametrically opposite thereto, and having further the circumferential portions of the ring intermediate of the said maximum bearing surface portions with a grooved construction giving to the ring a variable cross section at different positions circumferentially considered, the circumferential portions intermediate of the maximum bearing surfaces gradually decreasing in area and with the minimum surface positioned approximately 60° from the split ends.

3. The invention according to claim 1, wherein further, the grooved portions at each side of the split portion of the ring are connected by an exceedingly small groove adjacent to the body of the maximum bearing diametrically opposite to the split portion of the ring, whereby oil may pass from either grooved portion of the ring to the other for equalizing the distribution of the oil.

4. The invention according to claim 1, wherein further, the grooves radially considered increase in depth from the part diametrically opposite to the split ends and in directions toward said split ends, the depth being greatest at places nearer to the split ends of the ring than to the body part diametrically opposite to said split ends.

5. The invention according to claim 1, wherein further, the variable cross section is smallest at approximately 60° on each side of the split portion of the ring.

6. The invention according to claim 1,

wherein further, the body portion of the ring diametrically opposite from the split part thereof is provided with a very shallow and small groove connecting the reservoir grooves on opposite sides of the ring and opening to the edge of the ring body.

7. A piston ring split at one place in its circumference to normally form a gap and adapted to be compressed to form a true circle, and in which further, the outer peripheral surface increases transversely to the plane of the ring at each side of the gap and toward the diametrically opposite portion of the ring, and said increasing surface portions provided with a large number of parallel shallow grooves which furnish exceedingly small projecting parts adapted to quickly wear down to a true fit to the cylinder while at the same time maintaining a substantially continuous general perimeter to the ring.

8. The invention according to claim 1, wherein further, the grooves are formed of a radial variation in depth between the portions of greatest bearing surface, the greatest depth of the grooves being nearer to the split ends of the ring than to the portion of the ring diametrically opposite thereto.

9. The invention according to claim 1, wherein further, the grooves formed in the perimeter of the ring are of variable depth in a radial direction at different places circumferentially considered, and in which the greatest radial depth of the grooves are adjacent to those portions of the peripheral bearing surface presenting the minimum bearing surface.

10. A one-piece split expansible piston ring having an outer maximum bearing surface adjacent to the split ends and on the body diametrically opposite thereto, and having further circumferential portions of the ring intermediate of the said maximum bearing portions formed of a construction giving to the ring a variable cross section at different portions circumferentially considered, the circumferential portions intermediate of the maximum bearing surfaces being provided with gradually decreasing bearing surfaces and with the minimum surface at a distance from the split ends of the ring.

In testimony of which invention, I hereunto set my hand.

CLAUDE L. POST.