May 11, 1943. V. F. ZAHODIAKIN 2,319,098

PISTON RING

Filed June 5, 1940

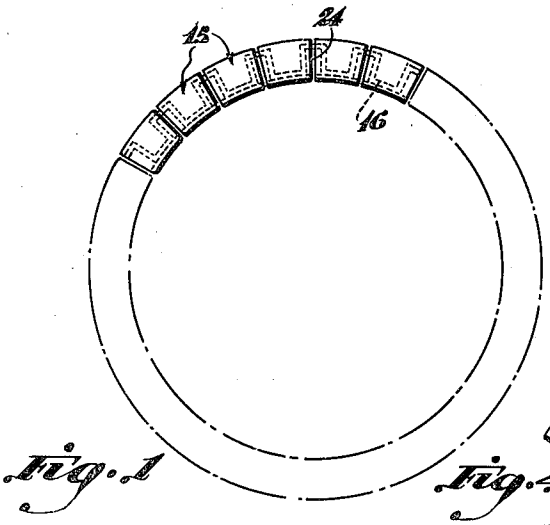


Fig. 1

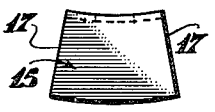


Fig. 2

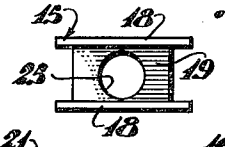


Fig. 3

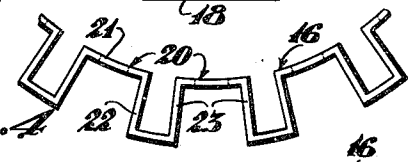


Fig. 4

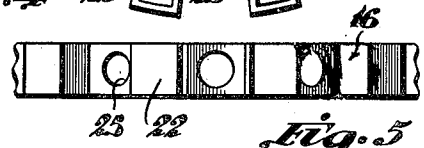


Fig. 5

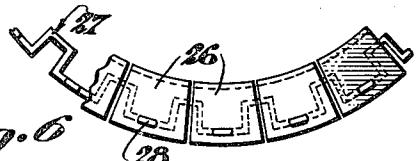


Fig. 6

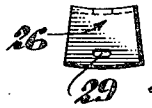


Fig. 7

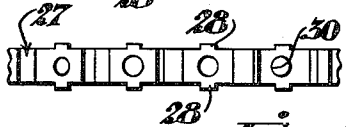


Fig. 9

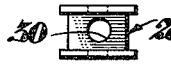


Fig. 8

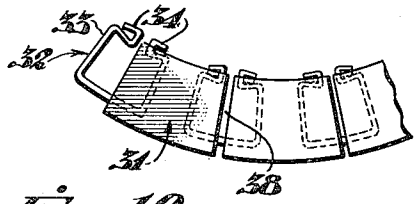


Fig. 10

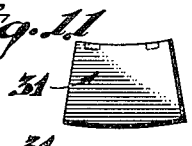


Fig. 11

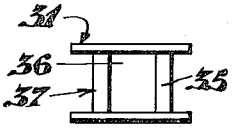


Fig. 12

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UNITED STATES PATENT OFFICE

2,319,098

PISTON RING

Victor F. Zahodiakin, New York, N. Y.

Application June 5, 1940, Serial No. 339,033

10 Claims. (Cl. 309—44)

This invention relates to improvements in oil rings of the type adapted to be used in pistons. The improved ring of this invention is of particular value for use as an oil ring for the pistons of internal combustion engines but is not limited to this use. It is capable of use with the same advantages, as the oil ring for the pistons of pumps, steam engines, or any installation where it is necessary to prevent the escape of oil along a cylinder wall past a cylinder. In this improvement the inventor has had the same general objects as in his copending application, Serial Number 309,021 filed December 13, 1939.

In the above mentioned copending application it has been the object to provide a ring having rigid box-like or tubular sections joined by spring means disposing the sections circumferentially with the spring means exerting circumferential pressure. These sections have been arranged so as to include a back wall having an oil clearance opening through which the oil flows radially from the open outer end of the sections. Due to the provision of a back wall with the spring means connected to it, all of the stresses resulting from circumferential forces have been carried by this wall which in turn is braced by the forwardly projected top and bottom walls of the sections constituting the top and bottom of the ring. In the above identified copending case, although the ring is disclosed as constructed of one piece, the invention has been considered broad enough to include a fabricated or assembled structure. This application is directed to constructions embodying separate sections and spring means.

Accordingly, it is the object of the present inventor in this case, in addition to the general objects heretofore mentioned, to provide a piston ring for controlling of the flow of oil in a cylinder, which ring is fabricated from a series of elements to constitute a structure which is sufficiently flexible for compression and expansion, but which includes an arrangement of the flexible means relative to the top and bottom walls of the ring whereby they do not buckle or bend as the ring compresses and expands in use.

An embodiment of this invention may consist of a series of U-shaped elements having their arms constituting the top and bottom of the ring and their base walls the back of the ring, and separate spring elements either continuous or separate between the respective sections. The spring elements may be attached to the sections either by welding or by spring clip arrangement.

Other objects of the inventor will be more fully apparent from a description of the drawing in which:

Figure 1 is a top plan view of a piston ring including the continuous spring means, a portion of the ring being shown diagrammatically.

Figure 2 is a top plan view of one of the sections separated from the ring.

Figure 3 is a front view of the section.

Figure 4 is a top plan view of a portion of the spring.

Figure 5 is a front view of the spring of Figure 4.

Figure 6 is a top plan view of a portion of a ring showing a modified arrangement of the sections and continuous spring element.

Figure 7 is a top plan view of a section element of Figure 6.

Figure 8 is a front view of the element of Figure 7.

Figure 9 is a front view of a portion of the spring element of the modification shown in Figure 6.

Figure 10 is a top plan view of a portion of a ring showing another modification in which separate spring elements are used between the sections.

Figure 11 is a top plan view of a section element used in the structure of Figure 10.

Figure 12 is a front view of Figure 11.

Referring to Figures 1 to 5 of the drawing, the sections are indicated at 15 and the continuous spring at 16. Each section is U-shaped in radial section and is segmental in top plan view, that is to say, its sides 17 are disposed on radial lines. The arms 18—18 of these sections constitute the top and bottom of the ring, and their bases 19 the rear wall.

The spring element 16 is formed of a flat strip of metal. It is corrugated as at 20 and bent into the form of a band or hoop. Its height is slightly less than the distance between the arms of the sections and the U-shaped sections are fitted over this band.

The inner crowns 21 of the corrugations lie against and are welded to the outside faces of the base walls 19 of the sections. The loops 22 between these crowns extend outwardly radially and provide the flexible connections between the sections. The loops or corrugations 22 have their arms 23 spaced apart sufficiently so as to be entirely between the arms of the sections that is, clear of the spaces 24 between the sections. Apertures 25 for oil passage are provided in the crowns of the corrugation and the back walls of the sections.

Thus the oil may pass between the arms of

adjacent spring loops 22 and the arms 18—18 of the U-shaped sections through those apertures 25 to the back of the ring. The sections are rigid and the spring loops are attached to the back walls of the sections. As in the copending case the strains resulting from compression and expansion of the ring in use, through the spring loop, are conveyed to the back walls 19. These walls are angularly braced by the arms 18—18.

In the modification shown in Figures 6 to 9 inclusive, the sections 26 are of the same shape as those of the first form shown herein. Also the spring means in this form is continuous. It is in the form of a corrugated band or hoop 27. The position of attachment of the spring element is varied in this form. The outwardly disposed crowns of the respective corrugations include lugs 28—28 extending upwardly and downwardly from the top and bottom edges centrally of the crowns. These lugs engage in apertures 29—29 in the upper and lower arms of the sections. Accordingly, it will be seen that, although the loops which provide the flexible connections are between the sections as in the preceding form, they are reversed as to radial position. In other words, the looped ends are disposed inwardly.

Thus the sections, the outer edges of which are accurately ground to fit the contour of the cylinder, are free to adjust themselves on the spring band so that they accommodate automatically to the contour of the cylinder. The connection between the sections and the spring is loose enough to permit this. Oil flow openings 30 are provided in the crowns of the corrugations and in the base walls of the sections.

In the modification shown in Figures 10 to 12 the sections are substantially the same. However, in this case, the sections 31 are held together by means of separate spring elements 32 between the respective sections. Each spring element consists of a U-shaped loop of sheet material disposed at right angles to the sections, that is, with the arms 33 of the spring element disposed parallel to the axis of the ring. These spring elements are disposed between the arms of the sections connecting the sections across the spaces between the sections. They include at their free ends, which are disposed inwardly, hook portions 34 providing means which will engage around the vertical margins 35 of an oil opening 36 in the back wall 37 of the section. As placed in position the arms of the springs are sprung inwardly toward each other to provide an expansive force on the sections. The side edges of the back wall 37 are set in from the side edges of the sections so as to place the hooks entirely between the walls of the sections clear of the slots 38.

As the sections and springs of any of these forms are assembled the radial edges 17—17 of the sections are properly spaced so that when inserted in the cylinder the spaces are minute. It will be noted that in each form the expansive or compression forces are not exerted through the top and bottom walls of the sections. In the first and third forms the connections are to the back walls, and in the second form to intermediate portions of the top and bottom walls. The connection, however, in the second form is loose and the strains are taken in the spring loop portions of the hoop.

As described in the copending application the rings are made of steel which is ductile enough to permit bending and which is heat treated and ground after it is formed into the parts making the rings. In all forms the outer peripheral edges of the rings are ground to the correct curvature.

Having described my invention, I claim:

1. A flexible piston ring constructed from sheet material, comprising, a series of separated circumferentially arranged sections consisting of separate elements, U-shaped in radial cross section and each providing an open front and perforated back wall, spring means interconnecting said sections, and means connecting said section to the spring means.

2. A flexible piston ring consisting of a plurality of independently formed U-shaped sections having their base walls constituting the back wall of the piston ring, a separate spring element interconnecting adjacent sections and generating circumferential pressure in the ring, and, means for securing said sections to said spring element.

3. A piston ring comprising a series of circumferentially arranged U-shaped sections having their base walls constituting the back wall of the piston ring and their arms the top and bottom walls of the piston ring and, a corrugated hoop having the crowns of its corrugations secured to the sections and providing loops between the sections whereby the ring is circumferentially expansible and compressible.

4. A piston ring comprising a series of circumferentially arranged U-shaped sections having their base walls constituting the back wall of the piston ring, and their arms the top and bottom of the piston ring and, a corrugated hoop having the crowns of its corrugations secured to the base walls of the sections thereby providing loops between the sections generating circumferential pressure in the ring.

5. A piston ring comprising a series of circumferentially arranged U-shaped sections having their base walls constituting the back wall of the piston ring, and their arms the top and bottom walls of the piston ring, and a series of spring loop elements having hook means at their free ends, said loop elements extending radially outwardly between the walls of adjacent sections, said back walls of the sections being perforated and said hooks engaged over the side margins of the perforations.

6. A piston ring comprising a series of circumferentially arranged U-shaped sections having their base walls constituting the back wall of the piston ring, and their arms the top and bottom of the piston ring and a corrugated hoop having the outer crowns of its corrugations loosely secured to the arms of the sections thereby providing loops between the sections generating circumferential pressure in the ring.

7. A piston ring comprising a series of circumferentially arranged U-shaped sections having their base walls constituting the back wall of the piston ring and their arms the top and bottom walls of the piston ring, and a series of spring loop elements, said loop elements extending radially outwardly between the walls of adjacent sections, and having their free ends attached to the base walls of adjacent sections.

8. A piston ring comprising a series of circumferentially arranged elements providing spaced walls constituting the top and bottom of the piston ring and a corrugated hoop having the crowns of its corrugations loosely secured to the walls thereby providing loops between the walls generating circumferential pressure in the ring.

9. A piston ring, comprising, a series of sections providing top and bottom elements spaced apart and constituting the top and bottom of the ring, a corrugated hoop element having its corrugations disposed between the top and bottom elements of the sections centrally thereof and connected thereto, the loops between the corrugations providing flexible connections between the sections.

10. A piston ring comprising an assembly of elements consisting of circumferentially arranged sections, said sections consisting of entirely separate elements each of which is U-shaped in radial cross section, and respectively providing top, bottom, and inner walls and spring loops connecting respective sections, said spring loops having their walls disposed axially relative to the axis of the ring and between the top and bottom walls of the sections, and thereby constituting side walls for the respective sections whereby said sections are maintained in position for radial and circumferential adjustment.

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