March 9, 1954 C. F. ENGELHARDT 2,671,705

OIL-CONTROL PISTON RING

Filed Nov. 1, 1951 3 Sheets-Sheet 1

Fig. 1.

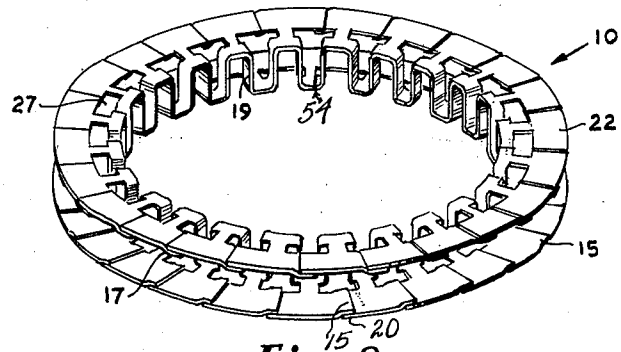


Fig. 2.

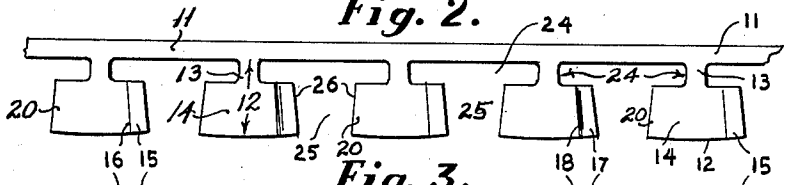


Fig. 3.

Fig. 4.

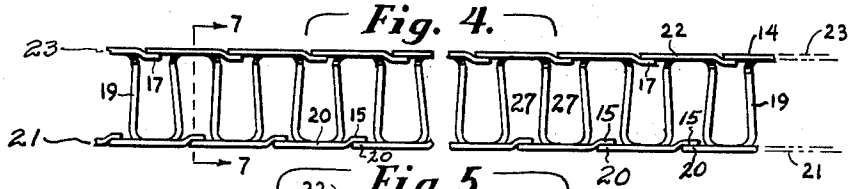


Fig. 5.

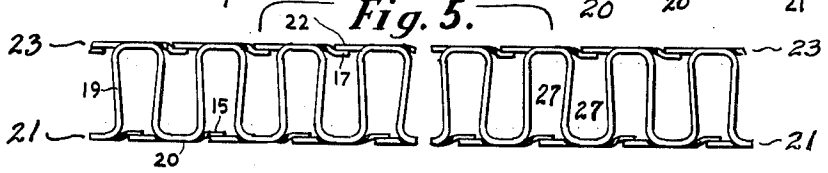


Fig. 6.

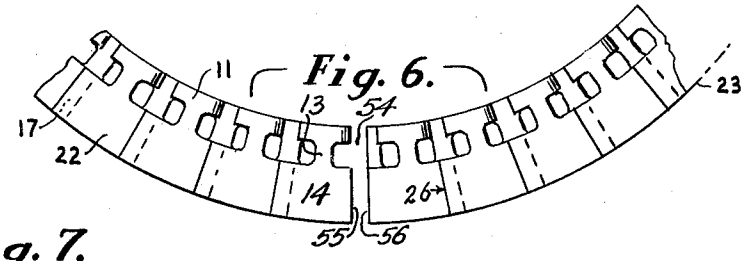
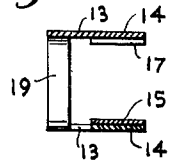


Fig. 7.



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March 9, 1954 C. F. ENGELHARDT 2,671,705

OIL-CONTROL PISTON RING

Filed Nov. 1, 1951 3 Sheets-Sheet 2

Fig. 8.

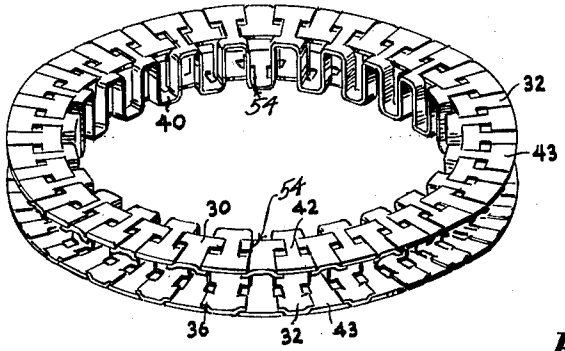


Fig. 9.

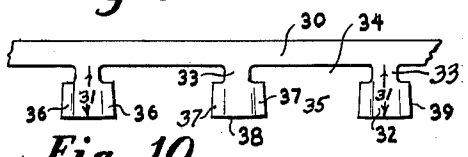


Fig. 11.

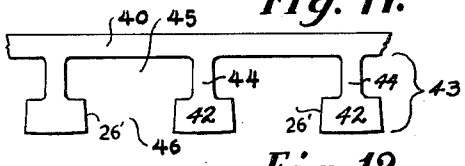


Fig. 10.

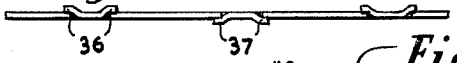


Fig. 12.

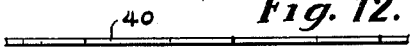


Fig. 13.



Fig. 14.

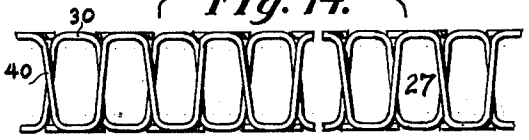


Fig. 16.

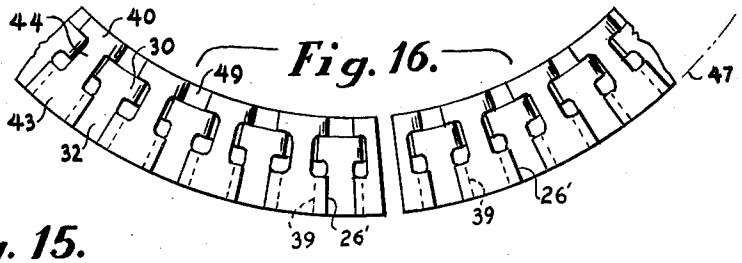
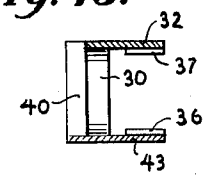


Fig. 15.



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OIL-CONTROL PISTON RING

Filed Nov. 1, 1951 3 Sheets-Sheet 3

Fig. 17.

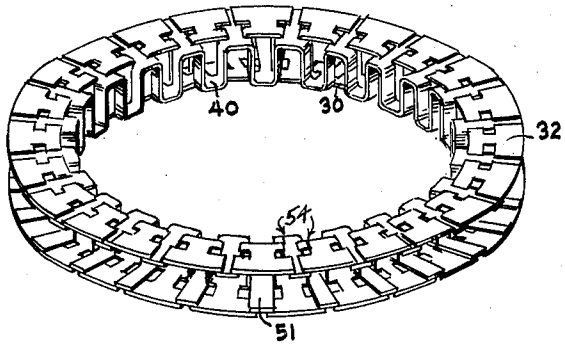


Fig. 18.

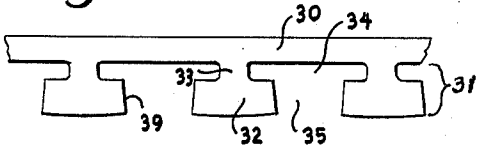


Fig. 20.

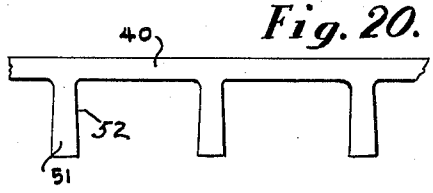


Fig. 19.



Fig. 21.

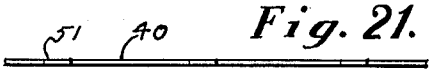


Fig. 22.

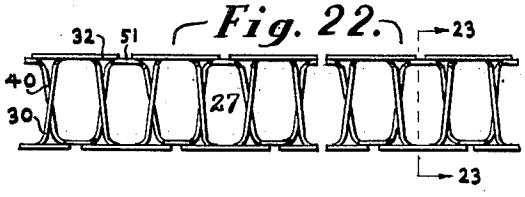


Fig. 24.

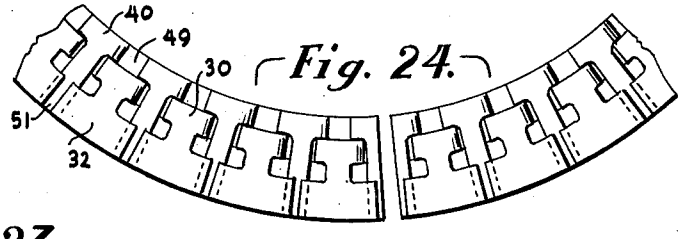
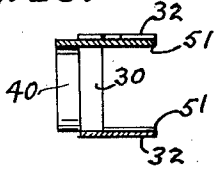


Fig. 23.



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Patented Mar. 9, 1954

2,671,705

UNITED STATES PATENT OFFICE

2,671,705

OIL-CONTROL PISTON RING

Carl F. Engelhardt, Yeadon, Pa., assignor to Wilkening Manufacturing Company, Philadelphia, Pa., a corporation of Delaware

Application November 1, 1951, Serial No. 254,309

9 Claims. (Cl. 309—29)

1

The present invention relates to certain new and useful improvements in piston-rings, of the self-expanding type and it relates more particularly to segmented flexible oil-control piston-rings adapted for use in internal combustion engines.

An object of the invention is to provide a simple, inexpensive and efficient self-expanding oil-control piston-ring for use in internal combustion engines, capable of conforming to any out-of-roundness of cylinder and which will be durable and comparatively easy to manufacture. Still another object of the invention is a more effective oil-control ring formed of one or more strips of sheet steel or other suitable sheet-metal, formed, bent and folded to provide a pair of relatively thin annular cylinder-contacting flanges and oil-passages therebetween.

Other objects and advantages of the present invention will appear from the following specification and accompanying drawings.

Broadly the invention comprehends a segmented self-expanding, resilient piston-ring having a generally continuous, axially corrugated band spaced substantially inwardly from the outermost periphery of the piston-ring and having cylinder-contacting segments extending directly radially outwardly from the upper and lower terminals or loops of successive corrugations, the adjoining radial marginal portions of adjacent cylinder-contacting segments overlapping each other with the overlapping surfaces generally contiguous to each other and with the circumferential extent of the overlapped marginal portions substantially less than the portions of the cylinder-contacting segments which are not overlapped.

The invention further comprehends a self-expanding, resilient piston-ring composed of a pair of intermeshed ring-elements each of which is provided with the corrugated band and the radially outwardly extending cylinder-contacting segments thereon, as outlined above, and the corrugated band of one ring-element is spaced radially inwardly (from the outermost periphery of the piston-ring) at a greater distance than the corrugated band of the other ring-element and the two corrugated bands are arranged concentrically and within the other and generally contiguous to each other, with the closed ends of the loops in one band adjacent the open end of the loops in the other band, and with the cylinder-contacting segments or extensions on the closed ends of the loops of the radially innermost corrugated band extending through the open ends

2

of the loops of the radially outermost corrugated band.

Any suitable sheet metal, such as sheet steel and the like may be used to form the ring of the present invention.

For the purpose of illustrating the invention, there are shown in the accompanying drawings forms thereof which are at present preferred, although it is to be understood that the various instrumentalities of which the invention consists can be variously arranged and organized and that the invention is not limited to the precise arrangements and organizations of the instrumentalities as herein shown and described.

Figure 1 represents a perspective view of a self-expanding piston-ring formed of a single strip of sheet metal, constituting one embodiment of the present invention.

Figure 2 represents a fragmentary top plan view of the ring-element of Figure 1, in its flat condition prior to corrugation.

Figure 3 represents an edge or side elevational view of Figure 2.

Figure 4 represents an outer side elevational view of the piston ring of Figure 1.

Figure 5 represents an inner side elevational view of the ring shown in Figure 1.

Figure 6 represents a top plan view of the ring of Figure 1.

Figure 7 represents a cross-section taken along the line 7—7 of Figure 4.

Figure 8 represents a perspective view of a modified piston-ring composed of two corrugated annular ring-elements.

Figure 9 represents a fragmentary top plan view of one of the ring elements of the embodiment shown in Figure 8 (namely, the ring element which has the outer of the two corrugated bands), shown in its flat condition, prior to corrugation.

Figure 10 represents an outer side elevational or edge view of Figure 9.

Figure 11 represents a fragmentary top plan view of the other of the ring elements of the embodiments shown in Figure 8 (namely, the ring element having the inner of the two corrugated bands), shown in its flat condition, prior to corrugation.

Figure 12 represents an outside elevational or edge view of Figure 11.

Figure 13 represents an outer side elevational view of the piston ring of Figure 8.

Figure 14 represents an inner side elevational view of the piston ring of Figure 8.

Figure 15 represents a cross-sectional view on line 15—15 of Figure 13.

Figure 16 represents a fragmentary top plan view of the piston ring of Figure 8, on a slightly larger scale, and showing the gap in the ring.

Figure 17 represents a perspective view of still another modified embodiment of the piston ring of the present invention, composed of two corrugated annular ring elements.

Figure 18 represents a fragmentary top plan view of one of the two ring elements of the piston ring of Figure 17 (namely, the one which has the outer of the two corrugated bands), shown in a flat condition, prior to corrugation.

Figure 19 represents a front side elevational or edge view of the flat ring element of Figure 18.

Figure 20 represents a top elevational view of the other of the two ring elements of the piston ring of Figure 17 (namely, the one which has the inner of the two corrugated bands), shown in a flat condition, prior to corrugation.

Figure 21 represents an outer side elevational or edge view of the flat ring element of Figure 20.

Figure 22 represents a fragmentary outer side elevational view of the ring of Figure 17.

Figure 23 represents a section on line 23—23 of Figure 22.

Figure 24 represents a fragmentary top plan view of the piston ring of Figure 17 on a somewhat larger scale, showing the gap.

In the embodiment shown in Figures 1 to 7, the ring is constructed from a single piece of sheet metal such as spring sheet steel or other suitable material, which is first stamped, cut out or otherwise formed generally to the shape indicated in Figures 2 and 3. As shown in these figures, the material from which the ring is made is formed with a relatively narrow band 11 from which project at regular intervals horizontal cylinder-contacting segments generally identified by the number 12. Each of these cylinder-contacting segments is composed of a relatively narrow or reduced portion or leg 13 and the outer cylinder-land-bearing section 14, which together form the generally T-shaped portions 12.

The outer circumferential edges of sections 14 are first cut (and later ground) on the radius of the cylinder to be fitted. One radial marginal portion (the right side as shown in Figures 2 and 3) of each of the sections 14 is bent (along lines 16 or 18) to form an off-set portion (15 or 17) which is in a plane parallel to and offset from the main portion of each T-shaped section 14. Alternate sections 14 have this off-set portion 15 projecting upwardly while remaining alternate off-set portions 17 are extended downwardly, as indicated in Figure 3.

The generally flat blank element shown in Figures 2 and 3 is then corrugated and the radial marginal portions of the segments 14 overlapped as shown in Figures 4 and 5, and then coiled into a circular form and cut to a single circle or convolution to form the ring shown in Figures 1 and 6. The upwardly off-set portions 15 on alternate segments 14 overlap the unbent marginal portions 20 of alternate segments 14, to form the continuous segmented and generally gap-less lower cylinder-contacting flange or edge 21 of the piston-ring, while the downwardly off-set marginal portions 17 on the remaining alternate segments 14 overlap the unbent marginal portions 22 of such alternate segments 14 to form the similar upper cylinder-contacting flange or edge 23 of the piston-ring.

The spaced-apart legs 13 extend generally at a right angle to the band 11 and directly outwardly therefrom, and are separated by more or less rectangular openings 24, from which extend the radial slots 25 formed between the cylinder-land-bearing segments 14. The slots 25 are preferably wider at their inner ends than at their outer ends, so that when the band 11 is corrugated and the ring is formed into a circle, the side-edges 26 of the segments 14 will be on generally radial lines, as indicated in Figure 6. A single gap 54 is formed in the circle.

The dimensions of the segments 14 and the distance between them are such that when the ring is in its final circular form and compressed in a cylinder, the overlapped marginal portions of the sections 14 have a circumferential extent which is less than, and preferably substantially less than the non-overlapped portions of the sections.

A flexible ring is thus provided with continuous upper and lower cylinder-contacting edges 21 and 23 which seal, scrape and control the oil on the cylinder-wall, with oil-drainage orifices or openings 27 formed by the axial loops, through which the excess oil removed from the cylinder-wall is drained back into the crank-case (through drain-holes extending from ring-receiving groove of piston to the interior of piston).

The ring is compressible circumferentially by flexing and stressing the legs of the U-shaped loops 19 of the axially corrugated band 11. The ring will tend to have a uniformly distributed radially outward expanding force, when circumferentially and radially compressed into the cylinder-wall, with its ends 55 and 56 abutting each other. This outward radial expansion of the ring, against the confining cylinder-wall, will be generally uniform at all points in the circumference. The ring will also conform to non-uniform or worn or out-of-round portions of the cylinder-wall, thus more effectively controlling the oil and reducing blow-by.

In the modified embodiment of the piston-ring of the present invention, shown in Figures 8 to 16, the ring is composed of two intermeshed ring-elements, the flat blank of which are shown separately in Figures 9 and 11. The two ring-elements together form a piston-ring with a pair of spaced-apart segmented but generally continuous oil-control cylinder-contacting flanges.

The flat blank of one of the ring-elements of this modification is illustrated in Figure 9, prior to corrugation. This ring-element is similar to that of Figure 2, and is provided with a narrow band 30 from which the cylinder-contacting segments 31 project directly outwardly. The segments 31 are composed of outer portions 32 connected to the band by relatively short legs 33. The band 30, the legs 33 and the cylinder-contacting segments 32 form relatively narrow more or less rectangular openings 34 and the relatively wide inwardly tapering slots 35. The radial marginal portions of each of the portions 32, are off-set (by bending) in the same direction, and these off-set portions (36 and 37) are parallel to the main or intervening portions of 32. The portions 36 on alternate elements 32 are off-set upwardly while the portions 37 on the remaining elements 32 are off-set downwardly, as is shown particularly in Figure 10. The cylinder-contacting edges 38 of the segments 32 also are cut or stamped to the shape of portions of a circle and are finally ground to a circle after the ring-element or ring is fully formed.

The flat blank of the second ring-element of

this modified form of oil-control ring is illustrated in Figures 11 and 12. As indicated in Figure 11, a flat sheet of suitable metal, such as a spring sheet-steel, is stamped or cut to the configuration shown in this figure, to provide a narrow band 40 having cylinder-contacting segments 42 forming parts of the T-shaped sections 43 connected to the band by relatively long legs 44, thus forming the relatively large rectangular opening 45 and the wedge shaped slots 46. The T-shaped sections 43 are flat, without any offset marginal portions, as is illustrated in Figure 12. The outer circumferential edges of these T-shaped sections 43 are also cut or stamped along portions of a circle of the compressed radius of the piston-ring, which edges are finally ground on such radius.

Each of the two ring-elements illustrated in Figures 9 and 11, respectively, is then corrugated in a manner similar to that described in connection with the ring of Figures 1 to 6, so that the portion of the bands 30 and 40 between the legs 33 and 44, respectively, form U-shaped loops in the respective bands, and so as to form generally continuous corrugated bands, of connected U-shaped loops, which are alternately open at opposite sides.

After the two ring-elements have been so corrugated, they are intermeshed as is shown in Figures 13 to 16, with the corrugated band 40 radially inwardly or contiguous to corrugated band 30, with the closed ends of the loops in band 40 adjacent the open ends of the loops of the band 30. The radial legs 44 on the band 40 extend radially through the open ends of the loops of the corrugated band 30 and the radially extending segments 42 of the corrugated band 40 overlap the off-set outer surfaces of the radially extending segments 32 of the corrugated band 30; thus forming generally continuous and generally gap-less oil sealing scraping and controlling cylinder-contacting flanges or edges 47 and 48 of the piston-ring.

The dimensions of the T-shaped sections 31 and 43 and the dimensions of the slots 35 and 46 and of the off-set marginal portions 36 and 37 of the segments 32 are such that the marginal portions of adjacent T-shaped cylinder-contacting segments 31 and 43 overlap each other in the manner generally indicated in Figure 13, with the overlapped marginal portions having a circumferential extent less (and preferably substantially less) than the non-overlapped portions of these segments. The radial extent of the legs 44 of the T-shaped segments 43 are such that when the outer edge of the corrugated band 40 is in contact with the inner edge of the corrugated band 30, the outer circumferential edges of the T-shaped segments 43 extend outwardly just as far as the outer circumferential edges of segments 31, so that the outer circumferential edges of both segments 31 and 43 will bear against the cylinder-wall with generally equal outward radial pressure when the ring is compressed therewithin. As shown particularly in Figure 16, the marginal side-edges 39 and 26' of the T-shaped segments 31 and 43, respectively, are generally radially disposed.

The flexible segmented oil-control ring thus formed with radial oil-drainage openings 27, wherein no open axial gap is left between segments at the outer periphery of the ring, thus reducing if not indeed eliminating blow-by between segments.

In the embodiment shown in Figures 8 to 16, inclusive (as well as in the embodiment shown in Figures 17 to 24, inclusive) any given or desired amount of outward radial cylinder-contacting pressure between the pair of flanges and the cylinder-wall (or the "unit pressure") can be achieved with less flexing or stressing of the convolutions or loops of the inner corrugated ring-expanding band or bands than is the case with the form of construction shown in Figures 1 to 7 inclusive.

Instead of the offset portions on the T-shaped segments of Figure 9, the T-shaped segments of Figure 11 may be appropriately offset. Instead of the relationship shown in Figure 13, the T-shaped segments 43 may be disposed interiorly of the T-shaped segments 31.

Another modified embodiment of the present invention is shown in Figures 18 to 24, inclusive. This modification also comprises two ring-elements in which the segments are intermeshed so as to reinforce each other and to close the gaps between segments of the cylinder-contacting flanges.

One ring-element is shown in Figures 18 and 19 and the other ring-element is shown in Figures 20 and 21.

The ring element shown in Figures 18 and 19 is similar to that shown in Figure 9, but with the cylinder-contacting flange segments 32 of somewhat greated circumferential extent, and is likewise provided with a relatively narrow band 30 having at regular intervals the integral legs 33 which carry the segments 32. The outer radial cylinder-contacting edges of the segments 32 are cut or stamped with their outer edges as parts of a circle of the radius of the piston ring when compressed in the cylinder. Likewise, the side-edges 39 are on lines generally corresponding to the radius of the ring when confined in the cylinder. This ring-element is also provided with the relatively narrow generally rectangular openings 34 and the relatively wide inwardly tapered slots 35. The segments 32 however are not provided with offset marginal portions (see Figure 19).

The second ring-element of this modification, shown in Figures 20 and 21, is generally similar to the ring-element shown in Figures 11 and 12 but with the cylinder-contacting flange segments 51 thereof being smaller circumferentially. The integral cylinder-contacting segments 51 instead of being T-shaped as in Figure 11 are generally straight, with the outer circumferential edges thereof also parts of the aforesaid circle, and with the side-edges thereof on lines generally corresponding to radii of the ring.

The two ring-elements shown in Figures 18 to 21 are corrugated in the same manner as described in connection with Figures 2, 9 and 11, after which they formed into a circle and are intermeshed in the manner described in connection with the modification of Figures 8 to 16, so that the corrugated band 40 is disposed radially inwardly of and contiguous to corrugated band 30 with the closed ends of the loops in band 40 adjacent the open ends of the loops in band 30. The cylinder-contacting segments 51 on the band 40 extend through the open ends of the loops in the band 30 and the outer end portions of segments 51 overlap the interior surfaces of the segments 32 of the band 30, and bridge the gaps therebetween to form generally continuous side-flanges having oil sealing, scraping and controlling edges.

In this modification also, the overlapped marginal portions of the segments have a circumferential extent which is less (and preferably substantially less) than the non-overlapped portions of these segments.

In the modification shown in Figures 17 to 24 the segments in each of the spaced parallel cylinder-contacting flanges of the ring may have one of the marginal overlapping portions thereof offset in relation to the margins of adjoining segments, with the non-offset portions disposed in such offset portion.

If desired, the segments **51** may be disposed exteriorly of the segments **31**.

In each of the embodiments of the present invention, the narrow outer circumferential edges of the pair of cylinder-contacting flanges are also ground to a true circle (corresponding to the cylinder in which the ring is to operate), and, if desired, the outer side-surfaces of the flanges may also be ground parallel, so as to present ground surfaces to the sides of the ring-receiving groove of the piston.

The oil-control rings of the present invention are to be used in the lower ring-receiving groove or grooves of the piston with oil-drain holes extending from the inner part of the ring-receiving groove to the interior of the piston.

In each of the embodiments of the present invention the flange-forming segments extend directly radially outwardly from the closed ends of the loops or convolutions of the corrugated ring-expanding band or bands, and bridge what otherwise would be a gap between adjacent segments at the outermost peripheries or at the cylinder-contacting zones of the flanges. Thus, each segment becomes a part of the cylinder-contacting flange on the same side of the piston-ring as that of the closed end of the loop of the corrugated band which carries the segment. By reason of this construction the segments are comparatively shorter and less subject to axial flexing and breakage than would be the case if the segments forming the flange on one side of the ring were connected to the corrugated band at the other side of the ring and were thus made to cross axially from one side of the ring to the other between the outer periphery of the ring and the point at which the segment is connected to the band.

Instead of having the cylinder-contacting portions (**14**, **32** and **42**) symmetrical in relation to the legs (**13**, **33** and **44**) which carry them, the cylinder-contacting portions or segments may be disposed asymmetrically in relation to said legs, with the laterally longer side of such cylinder-contacting portions overlapping the adjacent segment, with their overlapping marginal portions between such adjacent segment and the side-wall of the ring-receiving groove, and so as to be supported against axial flexing.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof, and it is therefore desired that the present embodiments be considered in all respects as illustrative and not restrictive, reference being had to the appended claims rather than to the foregoing description to indicate the scope of the invention.

Having described my invention, I claim as new and desire to protect by Letters Patent:

1. A segmented self-expanding resilient sheet-steel piston-ring having a pair of segmented cylinder-contacting side-flanges and an intervening circumferentially compressible and self-expanding inner portion intervening and connecting said flanges, said inner portion of said piston-ring comprising a relatively narrow axially corrugated band of successive integrally connected loops alternately open at opposite sides, a cylinder-contacting flange-segment integral with and extending directly radially outwardly from each of the closed ends of each of said loops to form said side-flanges and having generally radial side edges, one set of alternate flange-segments forming one side-flange and the other set of alternate flange-segments forming the other side-flange, relatively small marginal portions of the generally radial sides of adjacent flange-segments in each flange overlapping each other at the periphery of such flange and for some distance inwardly therefrom, the overlapped portions of said flange-segments being of substantially less circumferential extent than that of the non-overlapped portions thereof.

2. A segmented self-expanding resilient sheet-steel piston-ring having a pair of segmented cylinder-contacting side-flanges and an intervening circumferentially compressible and self-expanding inner portion intervening and connecting said flanges, said inner portion of said piston-ring comprising a relatively narrow axially corrugated band of successive integrally connected loops alternately open at opposite sides, and a cylinder-contacting flange-segment extending radially outwardly from each of the closed ends of each of said loops to form said side-flanges and having generally radial side edges, one set of alternate flange-segments forming one side-flange and the other set of alternate flange-segments forming the other side-flange, and marginal portions of the generally radial sides of adjacent flange-segments in each side-flange overlapping each other at the outer periphery of such side-flange and for some distance inwardly therefrom.

3. A segmented self-expanding resilient sheet-steel piston-ring having a pair of segmented cylinder-contacting side-flanges and an intervening circumferentially compressible and self-expanding inner portion interventing and connecting said flanges, said inner portion of said piston-ring comprising a relatively narrow axially corrugated band of successive integrally connected loops alternately open at opposite sides, and a cylinder-contacting flange-segment extending radially outwardly from each of the closed ends of each of said loops to form said side-flanges and having generally radial side edges, one set of alternate flange-segments forming one side-flange and the other set of alternate flange-segments forming the other side-flange, and marginal portions of the generally radial sides of adjacent flange-segments in each side-flange overlapping each other at the outer periphery of such-flange and for some distance inwardly therefrom, one of said marginal portions of each pair of overlapping marginal portions being offset inwardly by an amount approximately equal to the thickness of the other overlapping portion and such other overlapping portion being disposed within such offset.

4. A segmented self-expanding resilient sheet-steel piston-ring having a pair of segmented cylinder-contacting side-flanges and an intervening circumferentially compressible and self-expanding inner portion intervening and connecting said flanges, said inner portion of said piston-ring comprising a relatively narrow axially corrugated band of successive integrally connected loops alternately open at opposite sides, and a cylinder-

contacting flange-segment extending radially outwardly from each of the closed ends of each of said loops to form said side-flanges and having generally radial side edges, one set of alternate flange-segments forming one side-flange and the other set of alternate flange-segments forming the other side-flange, and marginal portions of the generally radial sides of adjacent flange-segments in each side-flange overlapping each other at the outer periphery of such side-flange and for some distance inwardly therefrom, one of said marginal portions of each pair of overlapping marginal portions being offset inwardly by an amount approximately equal to the thickness of the other overlapping portion and such other overlapping portion being disposed within such offset, the overlapped portions of said flange-segments being of substantially less circumferential extent than that of the non-overlapped portions thereof.

5. A segmented self-expanding resilient sheet-steel piston-ring having a pair of segmented cylinder-contacting side-flanges and an intervening circumferentially compressible and self-expanding inner portion interventing and connecting said flanges, said inner portion of said piston-ring comprising a relatively narrow axially corrugated band of successive integrally connected loops alternately open at opposite sides, a cylinder-contacting flange-segment extending directly radially outwardly from each of the closed ends of each of said loops to form said side-flanges, one set of alternate flange-segments forming one side-fiange and the other set of alternate flange-segments forming the other side-flange, and marginal portions of the sides of adjacent flange-segments of each flange overlapping each other.

6. A segmented self-expanding resilient sheet-steel piston-ring having a pair of segmented cylinder-contacting side-flanges and an intervening circumferentially compressible and self-expanding portion intervening said flanges, said piston-ring comprising two nested and intermeshed ring-elements each having a relatively narrow axially corrugated band of successive integrally connected loops alternately open at opposite sides, the corrugated band of one ring-element forming an inner circumferentially compressible intervening connection between one set of alternate segments in each of said side-flanges and the corrugated band of the other ring-element forming an inner circumferentially compressible intervening connection between the other set of alternate segments in the other of said side-flanges, said two corrugated bands being disposed concentrically in relation to and one within the other, with the open ends of the loops of one corrugated band being generally in radial alignment with the closed ends of the loops of the other corrugated band, a cylinder-contacting flange-segment integral with and extending radially outwardly from each of the closed ends of each of the loops of the two corrugated bands to form said side-flanges and having generally radial side-edges, alternate flange-segments extending from and carried by each corrugated band forming parts of opposite side-flanges, and one set of alternate flange-segments of each side-flange extending from and being formed integrally with one corrugated band and the other set of alternate flange-segments of each side-flange extending from and being formed integrally with the other corrugated band, the flange-segments of the inner corrugated band extending through the open ends of the loops of the outer corrugated band, all flange-segments, of each flange, extending to the outer periphery of the ring and having cylinder-contacting edge portions, and marginal portions of the generally radial sides of the adjacent flange-segments overlapping each other at the periphery of such flanges and for some distance inwardly therefrom.

7. A segmented self-expanding resilient sheet-steel piston-ring having a pair of segmented cylinder-contacting side-flanges and an intervening circumferentially compressible and self-expanding portion intervening said flanges, said piston-ring comprising two nested and intermeshed ring-elements each having a relatively narrow axially corrugated band of successive integrally connected loops alternately open at opposite sides, the corrugated band of one ring-element forming an innner circumferentially compressible intervening connection between one set of alternate segments in each of said side-flanges and the corrugated band of the other ring-element forming an inner circumferentially compressible intervening connection between the other set of alternate segments in each of said side-flanges, said two corrugated bands being disposed concentrically in relation to and one within the other, with the open ends of the loops of one corrugated band being generally in radial alignment with the closed ends of the loops of the other corrugated band, a cylinder-contacting flange-segment integral with and extending radially outwardly from each of the closed ends of each of the loops of the two corrugated bands to form said side-flanges and having generally radial side-edges, alternate flange-segments extending from and carried by each corrugated band forming parts of opposite side-flanges, and one set of alternate flange-segments of each side-flange extending from and being formed integrally with one corrugated band and the other set of alternate flange-segments of each side-flange extending from and being formed integrally with the other corrugated band; the flange-segments of the inner corrugated band extending through the open ends of the loops of the outer corrugated band, all flange-segments, of each flange, extending to the outer periphery of the ring and having cylinder-contacting edge portions, relatively small marginal portions of the generally radial sides of the adjacent flange-segments overlapping each other at the periphery of such flanges and for some distance inwardly therefrom, the overlapped portion of such flange-segment being of substantially less circumferential extent than that of the non-overlapping portions thereof.

8. A segmented self-expanding resilient sheet-steel piston-ring having a pair of segmented cylinder-contacting side-flanges and an intervening circumferentially compressible and self-expanding portion intervening said flanges, said piston-ring comprising two nested and intermeshed ring-elements each having a relatively narrow axially corrugated band of successive integrally connected loops alternately open at opposite sides, the corrugated band of one ring-element forming an inner circumferentially compressible intervening connection between one set of alternate segments in each of said side-flanges and the corrugated band of the other ring-element forming an inner circumferentially compressible intervening connection between the other set of alternate segments in each of said side-flanges, said two corrugated bands being disposed concentrically in relation to and one within the other, with the open ends of the loops

of one corrugated band being generally in radial alignment with the closed ends of the loops of the other corrugated band, a cylinder-contacting flange-segment integral with and extending radially outwardly from each of the closed ends of each of the loops of the two corrugated bands to form said side-flanges and having generally radial side edges, alternate flange-segments extending from and carried by each corrugated band forming parts of opposite side-flanges, and one set of alternate flange-segments of each side-flange extending from and being formed integrally with one corrugated band and the other set of alternate flange-segments of each side-flange extending from and being formed integrally with the other corrugated band; the flange-segments of the inner corrugated band extending through the open ends of the loops of the outer corrugated band, all flange-segments, of each flange, extending to the outer periphery of the ring and having cylinder-contacting circular edge portions, and marginal portions of the generally radial sides of the adjacent flange-segments overlapping each other at the periphery of such flanges and for some distance inwardly therefrom, one of said marginal portions of each pair of overlapping marginal portions being offset inwardly by an amount approximately equal to the thickness of the other overlapping portion and such other overlapping portion being disposed within such offset.

9. A segmented self-expanding resilient sheet-steel piston-ring having a pair of segmented cylinder-contacting side-flanges and an intervening circumferentially compressible and self-expanding portion intervening said flanges, said piston-ring comprising two nested and intermeshed ring-elements each having a relatively narrow axially corrugated band of successive integrally connected loops alternately open at opposite sides, the corrugated band of one ring-element forming an inner circumferentially compressible intervening connection between one set of alternate segments in each of said side-flanges and the corrugated band of the other ring-element forming an inner circumferentially compressible intervening connection between the other set of alternate segments in each of said side-flanges, said two corrugated bands being disposed concentrically in relation to and one within the other, with the open ends of the loops of one corrugated band being generally in radial alignment with the closed ends of the loops of the other corrugated band, a cylinder-contacting flange-segment integral with and extending radially outwardly from each of the closed ends of each of the loops of the two corrugated bands to form said side-flanges and having generally radial side edges, alternate flange-segments extending from and carried by each corrugated band forming parts of opposite side-flanges, and one set of alternate flange-segments of each side-flange extending from and being formed integrally with one corrugated band and the other set of alternate flange-segments of each side-flange extending from and being formed integrally with the other corrugated band; the flange-segments of the inner corrugated band extending through the open ends of the loops of the outer corrugated band, all flange-segments, of each flange, extending to the outer periphery of the ring and having cylinder-contacting circular edge portions, relatively small marginal portions of the generally radial sides of the adjacent flange-segments overlapping each other at the periphery of such flanges and for some distance inwardly therefrom, the overlapped portion of such flange-segment being of substantially less circumferential extent than that of the non-overlapping portions thereof, one of said marginal portion of each pair of overlapping marginal portions being offset inwardly by an amount approximately equal to the thickness of the other overlapping portion and such other overlapping portion being disposed within such offset.

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