

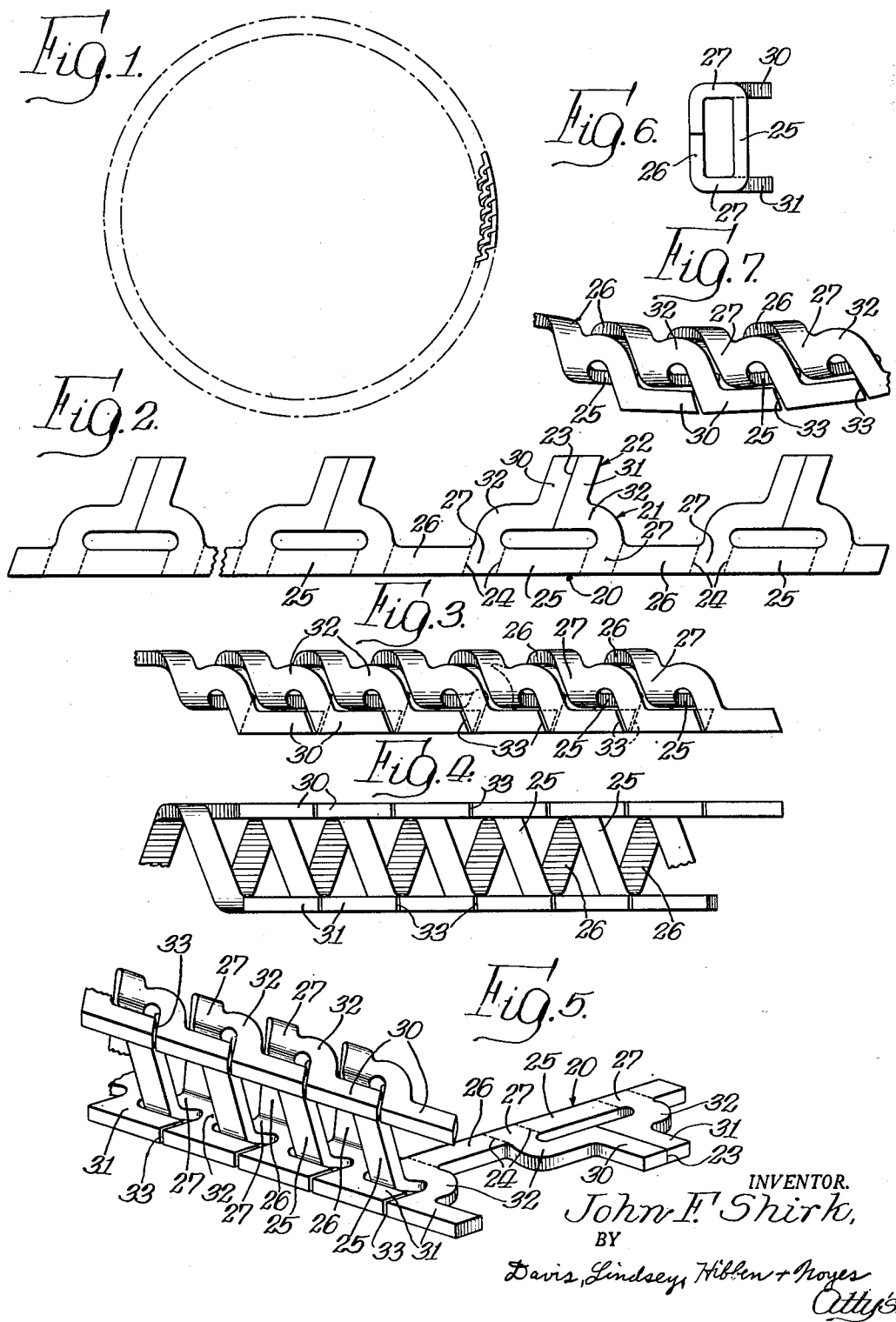
March 10, 1953

J. F. SHIRK
PISTON RING

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Filed Dec. 7, 1949

2 SHEETS—SHEET 1



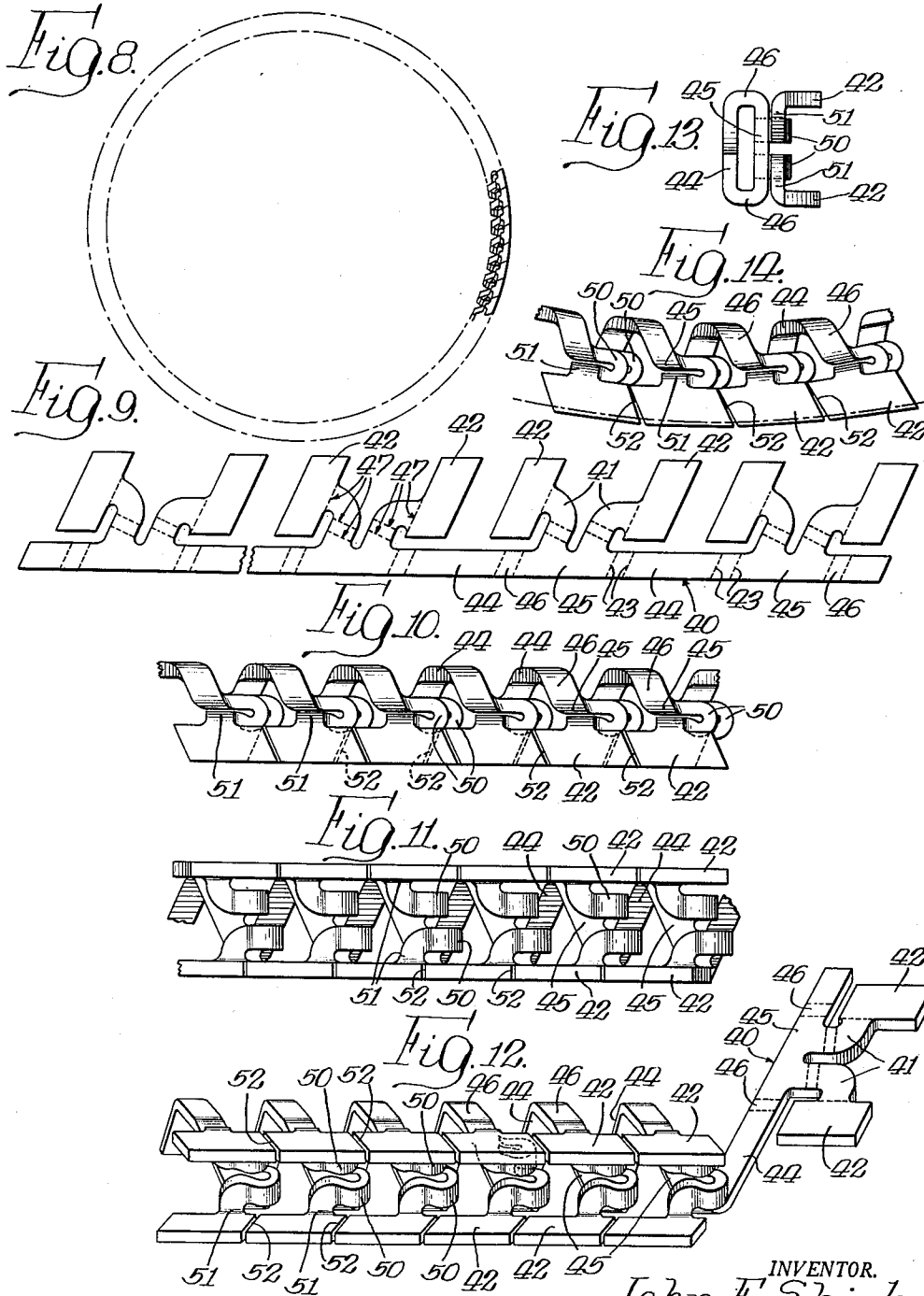
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2 SHEETS—SHEET 2



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PISTON RING

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The invention relates generally to piston rings and more particularly to a ring which may be made of sheet metal.

The general object of the invention is to provide a novel piston ring which is highly expandable circumferentially of the ring and likewise has a high degree of radial flexibility so that the ring readily conforms to the cylinder bore.

Another object of the invention is to provide a novel piston ring construction of the circumferentially expandable type, which utilizes the expansibility of a coiled spring to attain the circumferential resilience.

It is also an important object to provide a piston ring in which the circumferential expansibility is attained by winding a strip of sheet metal into the form of helix, with cylinder-engaging means integral with and extending from the helix. Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawings, in which:

Figure 1 is a plan view of a ring embodying the features of the invention.

Fig. 2 is a view, on an enlarged scale, showing the punched blank from which the ring is made.

Fig. 3 is a fragmentary plan view, on an enlarged scale, of a portion of the ring before it has been bent into annular form.

Fig. 4 is a fragmentary edge elevational view, on an enlarged scale, showing the ring before it has been bent into an annular form.

Fig. 5 is a fragmentary perspective view, on an enlarged scale, of the metal forming the ring and showing the manner in which it is folded to arrive at the structure shown in Figs. 3 and 4.

Fig. 6 is an end elevational view, on an enlarged scale, of the ring.

Fig. 7 is a fragmentary plan view, on an enlarged scale, of the ring and is similar to Fig. 3, except that it shows the ring after being bent into annular form.

Fig. 8 is a plan view of a modified form of ring.

Fig. 9 is a view, on an enlarged scale, showing the punched blank from which the ring of Fig. 8 is made.

Fig. 10 is a fragmentary plan view, on an enlarged scale, of the ring before it is bent into annular form.

Fig. 11 is a fragmentary edge elevational view, on an enlarged scale, of the ring before it is bent into annular form.

Fig. 12 is a perspective view, on an enlarged scale, showing the manner in which the strip is bent to form the ring.

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Fig. 13 is an end elevational view, on an enlarged scale, of the ring.

Fig. 14 is a fragmentary plan view, on an enlarged scale, and is similar to Fig. 10, except that the ring has been bent into annular form.

As indicated by the objects, a ring embodying the present invention is highly expansible circumferentially of the ring and, likewise, has a high degree of radial flexibility so that the ring readily conforms to the cylinder bore as it reciprocates therein. The ends of the ring, when in the cylinder, abut so that the resilience of the ring is utilized to effect the circumferential expansion. To this end, the ring comprises, as its basic structure, a helical winding or spring having its axis extending circumferentially of the ring so that the structure inherently provides a high degree of expansibility circumferentially of the ring. Extending from such helical winding are a plurality of segments arranged in rows engageable with the cylinder wall, the segments thus providing for flexibility radially of the ring so that, as the ring expands circumferentially, the segments permit such radial flexibility as is necessary to permit close adherence of the segments with the cylinder bore throughout the entire circumference of the ring.

In the preferred construction, the helical winding is formed by coiling a strip of sheet metal, and the segments are integral therewith and are held in suitable position by means of arms extending from the turns of the helix to the segments. The segments are preferably arranged in two axially spaced rows, and a segment in one row together with the adjacent segment in the opposite row, are both connected to the same turn of the helix. Thus, the circumferential expansibility of the helix is transmitted to the segments.

In the form of ring shown in Figs. 1 to 7 of the drawings, the ring is formed from a strip of sheet metal of uniform width and of sufficient length to form the helical winding heretofore referred to. Such strip is first punched into the form shown in Fig. 2. Thus, the strip is cut so that a continuous portion 20, of substantially less width than the original width of the strip, extends along one side. The remaining portion of the width of the strip is punched to provide loops, indicated generally at 21, having tongues, indicated generally at 22, extending to the opposite edge of the strip. The tongues 22 are slitted, as at 23, from their outer ends inwardly to the interior of the loops.

The continuous edge portion 20 of the strip is

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then wound into a helix. Preferably, each turn of the helix is generally rectangular in form, as is shown in Fig. 6, and, for this purpose, the edge portion 20 is folded transversely on the dotted lines 24 shown in Fig. 2. Thus, the longer portions 25 between two dotted lines 24, and constituting a portion of each loop 21, form the outer axially extending parts of the helix, while the longer portions 26 between two dotted lines, and located between the loops 21, constitute the inner axially extending portions of the helix, and eventually are located at the inner periphery of the ring. The shorter portions between the pairs of dotted lines 24, and indicated at 27, constitute the upper and lower portions of the turns of the helix and thus extend generally radially of the ring. There is thus formed a helix which extends circumferentially of the ring at the inner periphery thereof, as is apparent from an inspection of Figs. 6 and 7.

The tongues 22 provide the metal for the segments. Thus, each tongue 22 is divided by the slit 23 and thereby provides two segments 30 and 31. Each segment 30 is connected to one of the helix portions 27 by a portion of the loop 21, while the adjacent segment 31 is connected to another portion 27 of the helix by another portion of the loop 21. Since the two mentioned portions 27 respectively form the upper and lower portions of the helix diametrically opposite each other, the segments 30 will lie in a plane axially spaced from the segment 31, so that the segments 30 form the upper row or cylinder-engaging flange, while the segments 31 form the lower row or cylinder-engaging flange. The slitted edges 23 of the segments 30 and 31 thus become the cylinder-engaging edges of the segments. The portions of each loop 21 which connect the segments 30 and 31 with the portion of the strip constituting the helix, and particularly with the portions 27 thereof, form curved arms 32 which, in the final form of the ring, first extend circumferentially from one edge of each turn of the helix and then curve outwardly to place the segments radially outward of the helix at the outer periphery of the ring. It will also be noted, by an inspection of Fig. 5, that each segment 30 and the adjacent segment 31 both extend from a single turn of the helix. It will also be noted that the segments lie in the same planes with the upper and lower portions of the helix, that is, with the upper and lower portions 27.

The pitch of the helix is such as to provide narrow slits 33 between the segments which are tapered in width when the strip is given its annular form, as illustrated in Fig. 7. The slits 33 in the two rows of segments are aligned, as shown in Fig. 4, at the outer periphery of the ring but they are preferably positioned at a slight angle to a radius with the slits in one row being of opposite angularity to those in the other row, as indicated in Figs. 3 and 5.

The ring shown in Figs. 8 to 14, inclusive, is similar to the ring heretofore specifically described but differs therefrom by the fact that the segments are integrally connected by arms to axially extending portions of the helix. More specifically, a segment from each of the two rows is connected to a single axially extending portion of the helix.

The ring shown in these figures is fabricated in a manner similar to the previously described form. Thus, the ring is formed from a strip of metal punched so as to provide a continuous strip, indicated generally at 40, lying along one edge of

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the original strip of metal. The original strip is also punched to provide pairs of arms 41, and on the ends of the arms the portions 42 are provided, which eventually become the cylinder-engaging segments. To form the helix, in this instance, the strip 40 is folded along the dotted lines 43, which results in a helix of generally rectangular form, as shown in Fig. 13, comprising inner axially extending portions 44, outer axially extending portions 45, and generally radially extending portions 46.

It will be noted from an inspection of Fig. 9, that the arms 41 for two segments 42 both extend from the same part 45 which constitutes an outer axially extending portion of the helix. To place the segments 42 in two axially spaced rows at the outer periphery of the ring, the arms 41 are bent in three places, indicated by the dotted lines 47 in Fig. 9, two of such dotted lines being shown as lying transversely to the arms intermediate their ends, while the third dotted line is shown at the point where the arm 41 meets the segment 42. The two lines of folding 47, which are intermediate the ends of each arm 41, provide for a reverse bend, shown at 50 in the remaining figures. This positions the segments and the arms outside of the outer turn 45 of the helix. Each segment 42 is then bent along the third dotted line 47, as indicated at 51, so that it is substantially perpendicular to the arm 41 and the segment thereby extends radially from the helix. The segments thus are arranged in two axially spaced rows to form cylinder-engaging flanges. The bending of the arms 41 is also such as to position the segments 42 in the same planes with the upper and lower portions 46 of the helix.

The pitch of the helix is such as to bring the segments close to each other to form the two rows or flanges with only narrow slits 52 between the segments. These slits, before the ring is bent into annular form, are of uniform width throughout their radial length, but are tapered in form in the final ring, as indicated in Fig. 14, because of the bending into annular shape. It will also be noted, from an inspection of Figs. 11 and 12, that the slits 52 in the respective flanges or rows are in somewhat staggered relation. Furthermore, because the segments are originally punched with end edges which are non-perpendicular to the cylinder-engaging edges as illustrated in Fig. 9, the slits 52 occupy a non-radial position and are at a slight angle to a radius. Moreover, the particular punching employed results in slits 52 which slant in one direction from the radius in one flange while the slits 52 in the other flange slant in the opposite direction from the radius and thus have opposite angularity.

With a ring of either form shown in the drawings, the helix provides high expansibility, which is inherent in a helix, while a high degree of radial flexibility is attained by the segmental construction of the cylinder-engaging flanges.

I claim:

1. A piston ring comprising a helical winding extending circumferentially of the ring, and a plurality of cylinder-engaging segments arranged in a circumferentially extending row and connected to the turns of the helix.

2. A piston ring comprising a coiled spring, the axis of which extends circumferentially of the ring, and cylinder-engaging means comprising a plurality of segments arranged in a circumferentially extending row and each connected to only one coil of the spring.

3. A piston ring comprising a helical winding

at the inner periphery of the ring and extending circumferentially, and a pair of axially spaced cylinder-engaging flanges extending to the outer periphery of the ring, each flange comprising a plurality of segments connected to the turns of the helix.

4. A piston ring comprising a helical winding at the inner periphery of the ring and extending circumferentially, and a pair of segments rigid with each turn of the helix and positioned in axially spaced relation to each other, said segments providing a pair of cylinder-engaging flanges forming the outer periphery of the ring.

5. A piston ring comprising a helical winding, and a pair of segments connected to diametrically opposite portions of each turn of the helix and extending outwardly of the ring to provide a pair of cylinder-engaging flanges.

6. A piston ring comprising a helical winding extending circumferentially of the ring, and a pair of segments connected to each turn of the helix at the upper and lower faces of the ring, the segments together providing a pair of axially spaced cylinder-engaging flanges.

7. A piston ring comprising an elongated strip of sheet metal wound into a helix and having a plurality of segments integrally connected to the turns of the helix to provide cylinder-engaging means.

8. A piston ring comprising an elongated strip of sheet metal wound into a helix extending circumferentially of the ring, a plurality of segments providing a pair of axially spaced cylinder-engaging flanges, and a plurality of arms integrally connecting the segments with the turns of the helix.

9. A piston ring comprising an elongated strip of sheet metal wound into a helix extending circumferentially of the ring, said strip having a plurality of arms extending laterally from the strip and having a plurality of segments formed on the free ends of the respective arms and providing a pair of axially spaced cylinder-engaging flanges.

10. A piston ring comprising an elongated strip of sheet metal wound into a helix extending circumferentially of the ring, said strip having a plurality of arms extending from one side edge of the strip and having a plurality of segments formed on the free ends of the respective arms, the helical form of the strip locating said segments in two circumferential lines comprising axially spaced cylinder-engaging flanges.

11. A piston ring comprising an elongated strip of sheet metal wound into a helix extending circumferentially of the ring, a plurality of segments located radially outside of the helix, and a plurality of arms connecting the segments with the helix.

12. A piston ring comprising an elongated strip of sheet metal wound into a helix extending circumferentially of the ring, a plurality of segments located radially outward of the helix, and a plurality of arms, one for each segment, connecting the segments with the helix, a pair of segments from the respective rows being connected to each turn of the helix.

13. A piston ring comprising an elongated strip of sheet metal wound into a helix extending circumferentially of the ring, a plurality of segments integrally connected to the helix and arranged in two axially spaced rows located radially outside of the helix, the axial height of the helix being the same as the distance between axially outer faces of the rows of segments.

14. A piston ring comprising an elongated strip of sheet metal wound into a helix extending circumferentially of the ring, with the helix being generally rectangular in radial cross section, the longer sides of the rectangle extending generally axially and the shorter sides generally radially, and a plurality of segments integrally connected to the helix and arranged in two axially spaced rows located radially outside of the helix and lying in the planes of said shorter sides.

15. A piston ring comprising a strip of sheet metal wound into a helix and having a plurality of segments integrally connected to the upper and lower portions of the turns of the helix.

16. A piston ring comprising a strip of sheet metal wound into a helix of generally rectangular form in radial cross section, each turn of the helix thereby having portions extending generally axially and portions extending generally radially, and a pair of segments for each turn of the helix, the segments of each pair being integral with the respective radially extending portions of each turn.

17. A piston ring comprising a strip of sheet metal wound into a helix extending circumferentially of the ring, each turn of the helix having upper and lower portions extending generally radially of the ring, a pair of arms integral with the respective upper and lower portions of each turn and extending outwardly therefrom, and a segment on the free end of each arm, the segments being arranged in two axially spaced circumferentially extending rows.

18. A piston ring comprising a strip of sheet metal wound into a helix, each turn of the helix having upper and lower portions extending generally radially of the ring, and a pair of arms integral with and extending circumferentially from the edges of the respective upper and lower portions of each turn, said arms curving outwardly and having cylinder-engaging segments formed on their ends.

19. A piston ring comprising a strip of sheet metal wound into a helix extending circumferentially of the ring, each turn of the helix having portions extending generally axially of the ring and a plurality of segments integrally connected to said axially extending portions.

20. A piston ring comprising a strip of sheet metal wound into a helix extending circumferentially of the ring, each turn of the helix having inner and outer portions extending generally axially of the ring, and a pair of segments integrally connected to the outer portion of each turn, with the segments arranged in two axially spaced rows.

21. A piston ring comprising a strip of sheet metal wound into a helix extending circumferentially of the ring, each turn of the helix having inner and outer portions extending generally axially of the ring, a pair of axially spaced rows of segments, and a pair of arms connecting segments from each row to each turn of the helix, said arms extending circumferentially from the edges of said outer portions and being bent to position said segments in said rows.

22. A piston ring comprising a strip of sheet metal wound into a helix and having two axially spaced rows of segments integrally connected to the turns of the helix and separated by slits, each slit being angularly related to a radius extending to the slit, and the slits in one row being of opposite angularity to those of the other row.

23. A piston ring comprising a strip of sheet

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metal successively bent at intervals to provide portions extending generally axially of the ring connected by portions extending generally radially of the ring, with alternate axially extending portions spaced radially from the remaining axially extending portions, and two rows of segments integrally connected to said radially extending portions.

24. A piston ring comprising a strip of metal comprising a series of sections with the strip successively bent in forming each section to provide a portion extending generally axially, then a portion extending generally radially at one side of the ring, then a portion extending axially and then a portion extending radially at the other side of the ring, each section also including a pair of segments integrally connected to the respective radially extending portions.

25. A piston ring comprising a pair of rails each comprising a plurality of segments, web portions extending generally axially of the ring with alternate web portions offset radially of the ring from the remaining web portions, and portions serially connecting the web portions and integrally connected to the segments and located in the planes thereof, each of said connecting por-

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tions having two web portions integrally connected thereto.

26. A piston ring comprising a strip of sheet metal bent to provide a supporting structure comprising upper and lower portions connected by portions extending generally axially, the latter portions being spaced circumferentially from each other with alternate portions offset radially from the remaining portions, and segments extending from and integrally connected to the upper and lower portions.

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