June 16, 1953 M. O. TEETOR 2,642,324

PISTON RING ASSEMBLY

Filed March 15, 1951

Fig. 1.

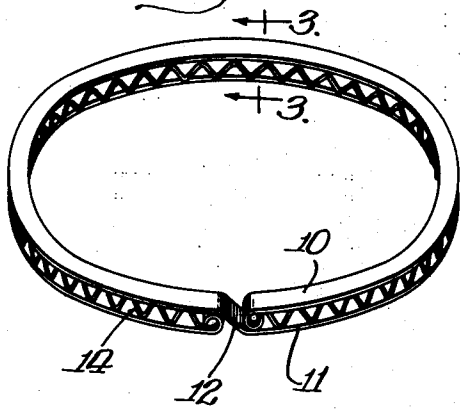


Fig. 3.

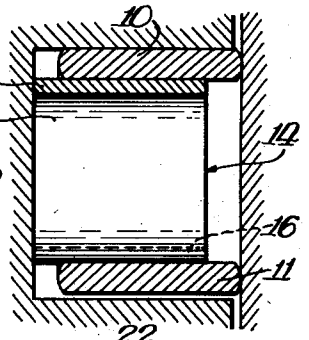


Fig. 5.

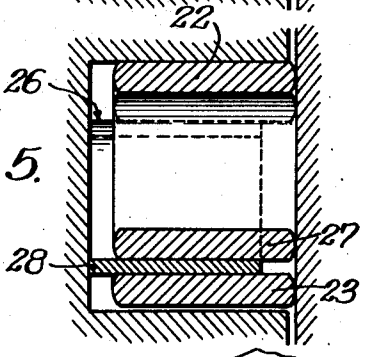


Fig. 2.

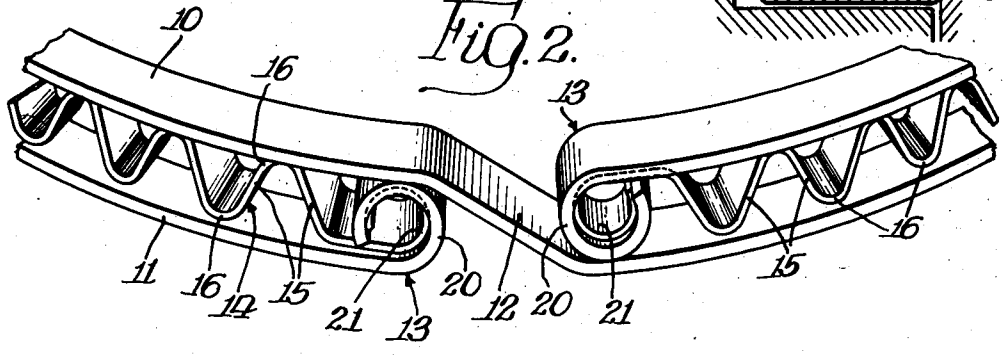
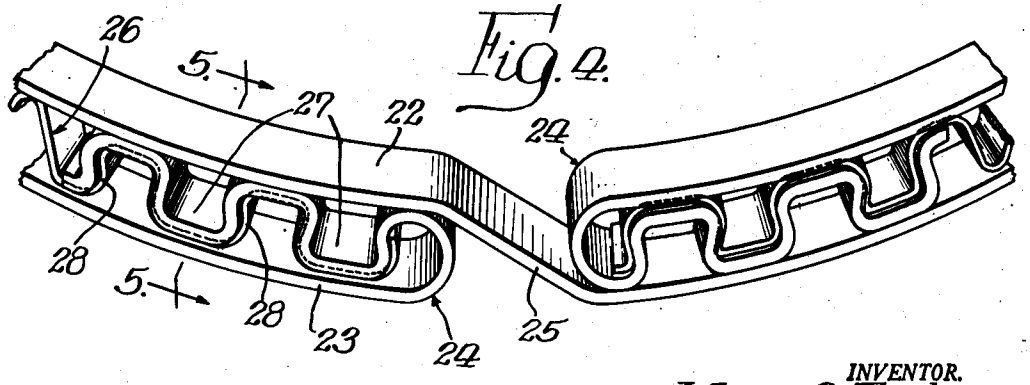


Fig. 4.



INVENTOR.
Macy O. Teetor,
BY
Davis, Lindsey, Hibben & Noyes
Attys.

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PISTON RING ASSEMBLY

Macy O. Teetor, New Orleans, La., assignor to Perfect Circle Corporation, Hagerstown, Ind., a corporation of Indiana

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13 Claims. (Cl. 309—45)

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The invention relates generally to piston rings and more particularly to a ring assembly adapted for use as an oil ring.

The general object of the invention is to provide a novel ring structure capable of exerting substantially uniform pressure against the cylinder wall throughout the circumference of the ring.

Another object is to provide a novel ring structure comprising a pair of axially spaced rail elements which exert substantially equal pressure against the cylinder wall uniformly throughout the circumference of the ring.

A further object is to provide a novel ring structure comprising a pair of axially spaced rail elements with all portions of each rail free to expand radially to conform to the cylinder wall but with a pressure which is uniform throughout the circumference of the ring.

Other objects and advantages will become apparent from the following description taken in connection with the accompanying drawing, in which:

Fig. 1 is a perspective view of a ring structure embodying the features of the invention;

Fig. 2 is an enlarged perspective view of a portion of the ring structure shown in Fig. 1;

Fig. 3 is a transverse sectional view on a still larger scale of the ring structure, taken substantially on the line 3—3 of Fig. 1 but showing the ring mounted on a piston within a cylinder;

Fig. 4 is a view similar to Fig. 2 but showing a modified form of ring structure; and

Fig. 5 is a transverse sectional view on an enlarged scale, taken substantially on the line 5—5 of Fig. 4.

The advantages of a ring construction which includes two axially spaced rails are well understood where such construction is used as an oil ring. Thus, such construction has the advantage of providing two oil scraping edges engaging the cylinder wall, but independence of action of the two rails in ring assemblies heretofore used has not been atttained to the desired degree becaues of the character of the spacing and expanding means utilized with the two rails. In most ring assemblies of this type, a single expander is provided to act on both rails and it consequently bears equally against both so that one is not expanded unless the other one is also expanded to the same extent. Moreover, the expander tends to exert outward pressure on the rails at certain circumferentially spaced points so that uniformity of outward pressure at every point circumferentially of each rail is not fully attained.

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A ring assembly has also been made where endwise pressure is exerted on a pair of rails at their ends by a spring means provided with abutments engaging the ends of the rails at the gap. But it is evident that, unless the two rails are of exactly the same circumferential length, the two rails will not engage the cylinder wall with equal pressure. Moreover, even if the rails are of equal length, they are expanded to the same extent so that they cannot act independently of each other.

The present invention provides a ring assembly comprising a pair of rails so arranged and so cooperating with spring means that uniform pressure will be exerted by both rails throughout their lengths against the cylinder wall. And, more importantly, each rail is free to expand independently of the other rail although only a single spring means may be used to cause such expansion. The two rails comprise a single strip of rail material formed into two axially spaced turns with the turns connected by a cross-over portion extending between the ends of the strip. To expand the turns, spring means located between the planes of the two turns is provided and coacts with the ends of the strip to force said ends apart.

In the embodiment of the invention illustrated in Figs. 1 to 3, inclusive, the rail structure is formed from a single strip bent to provide two turns or rails 10 and 11, respectively, positioned in axially spaced planes. Since both turns are part of the same strip, they are integrally connected by a cross-over portion 12 which is located between the ends of the strip, said ends being indicated generally at 13. In the present instance, the cross-over portion 12 is slanted as is evident from an inspection of Fig. 2.

Cooperating with the strip which provides the rails 10 and 11 and particularly with the ends 13 is a spring means which tends to separate the ends 13 circumferentially. Said spring means lies between the planes of the two turns 10 and 11 and in the present instance extends from one end 13 away from the gap and around the ring to the other end 13. While the spring means may be made in various forms, it is here shown as a single strip of metal, indicated generally at 14, which is corrugated so that it may expand and contract but is inherently contractile so that it tends to pull the ends 13 away from each other. The corrugations may of course be of various forms but are illustrated as comprising slanting sides 15 connected by rounded portions 16. The axial height of the corrugations is such that, within the range of flexing neces-

sary for the spring to function, the rails or turns 10 and 11 will be held closely adjacent the sides of the ring groove in the piston but will not be forced against the sides under pressure. If the turns 10 and 11 were held against the sides of the groove under pressure, the turns would not be free to move radially to conform to the wall of the cylinder. By dimensioning the corrugations so that they will never press the rails or turns against the sides of the grooves, this difficulty is avoided and the rail may freely flex radially. However, the corrugations are of sufficient height to hold the rails properly spaced.

The ends of the strip 14 constituting the spring means are, of course, formed for engagement with the ends 13 of the rails or turns. Preferably, the contact between the strip 14 and the ends 13 extends over a substantial area so that there are no sharp edges of one part engaging the other part, which might result in undue wear or breakage of one or the other of the parts. In the present instance, the large area of contact between the two parts is obtained by forming the ends of both parts into interfitting loops. Thus, each end 13 of the strip forming the rails 10 and 11 is reversely curved to form a rounded loop 20, while each end of the strip 14 is reversely curved to form a rounded loop 21. Each loop 21 is of smaller diameter than the loop 20 and fits snugly within the latter so that the two engage throughout a substantial portion of the length of each strip, thus providing a relatively larger area of contact to support the force exerted by the spring action of the corrugations. The interfitting loops 20 and 21 are readily engaged and disengaged so that the spring and the strip providing the rails may be readily assembled and disassembled.

The form of the ring assembly shown in Figs. 4 and 5 functions similarly to the first described form but has the added feature of providing for adjustment of the force exerted by the spring means on the ends of the rails. In this form as in the other form, a single strip of metal is shaped to provide two turns constituting rails 22 and 23 having ends indicated generally at 24 and a cross-over portion 25 extending between the two ends 24 and connecting the two rails. Extending from one end 24 around the ring to the other end in the space between the two rails 22 and 23 is a spring means comprising a strip 26 of metal which may be corrugated similarly to the strip 14 in the first form.

To provide for connection of the ends of the strip 26 with the ends 24 and to permit adjustment therebetween to vary the force exerted by the spring means on the ends 24, the latter are reversely bent to extend into the space between the rails 22 and 23 and the reversely bent portions are formed into a series of equally spaced corrugations 27. The corrugations at the ends of the strip 26 are similarly shaped as at 28 so that the two sets of corrugations 27 and 28 can be nested in one another. The strip 26 is thus connected to the ends 24 and tends to separate them to expand the rails 22 and 23. It will be evident, however, that any one of the corrugations 27 will interfit with any of the corrugations 28. Thus, if it is desired to adjust the force exerted by the spring means on the rails, the corrugations 28 of the strip 26 may be detached from the corrugations 27 and shifted circumferentially a distance equal to the spacing between corrugations and then re-engaged. If it is desired, to make an adjustment equal to two such spacings, it is of course preferable to make an adjustment of one spacing at each end 24.

From the foregoing description, it will be apparent that the tendency of the spring means to contract results in a pull at the ends of the strip forming the rails in a direction tending to separate these ends. Since the two rails are integrally connected by the cross-over position, such separation of the ends tends to expand both rails but the expansion of the respective rails does not necessarily have to be exactly the same. Thus, the expansion resulting from a separating movement of the ends may occur in the two rails to different degrees. The extent of expansion of course, is determined by the cylinder wall and with the present construction both rails will expand with substantially equal pressure against the wall. Thus, this construction is of particular advantage in cylinders which are worn to a taper since both rails will exert the same pressure against the wall although the expansion of the rails will differ. Moreover, the expansive force exerted by the spring means circumferentially on the ends will result in substantially uniform outward pressure of the rails throughout their entire circumference, thus avoiding points of excess pressure. The ring assembly thus provides substantially uniform pressure in both rails throughout their circumferential length.

I claim:

1. A piston ring structure comprising a pair of rails positioned in axially spaced planes, each rail having one end free and the other ends of the rails being integrally connected by a cross-over portion extending from one rail to the other between the free ends, and spring means positioned between the planes of the rails and connected to the free ends of the rails to expand the rails by separation of said free ends.

2. A piston ring structure comprising a strip of metal bent to form two concentric turns positioned in axially spaced planes and having a portion connecting the turns extending from one turn to the other between the ends of the strip, and separate spring means positioned between said planes and engaging the ends of the strip to expand said turns.

3. A piston ring assembly comprising rail structure comprising a strip of metal bent to form two concentric turns positioned in axially spaced planes and having a portion connecting the turns and extending between the ends of strip, and a spring member positioned between the turns and secured to the ends of the strip and tending to separate the ends circumferentially.

4. A piston ring assembly comprising a strip of metal bent to form two concentric turns positioned in axially spaced planes and having a portion connecting the turns and angularly bent relative to the two turns to extend axially and circumferentially between the two ends of the strip, and a contractile spring member positioned between the turns and connected to said ends and tending to separate said ends circumferentially.

5. A piston ring assembly comprising a strip of metal bent edgewise to form two concentric flat turns with the edges of the strip at the inner and outer peripheries of the turns, said turns being connected by a slanting portion and the ends of the strip being positioned in the respective turns and at the respective sides of said slanting portion, and an elongated contractile spring connected at its ends to said ends of the

strip and extending circumferentially between the turns.

6. A piston ring assembly comprising a strip of metal bent edgewise to provide two concentric turns in axially spaced relation and connected by an intermediate portion extending between the ends of the strip, said ends being formed into loops located between the turns, and a contractile spring having loops at its ends interfitting with the loops on the strip to secure the spring thereto, said spring extending circumferentially between the turns and tending to separate the ends of the strip to expand the turns.

7. A piston ring assembly comprising a strip of metal bent edgewise to provide two concentric turns in axially spaced relation and connected by an intermediate portion extending between the ends of the strip, said ends being reversely bent to form rounded loops between the turns, and a contractile spring having rounded loops at its ends fitting snugly within and conforming to the shape of the first mentioned loops to secure the spring thereto, said spring tending to separate the ends of the strip to expand the turns.

8. A piston ring assembly comprising a strip of metal bent edgewise to provide two concentric turns in axially spaced relation and connected by an intermediate portion extending between the ends of the strip, and a contractile spring comprising a corrugated strip of metal interposed between the turns and connected at its ends to the ends of the first-mentioned strip and tending to separate them to expand the turns.

9. A piston ring assembly comprising a strip of metal bent edgewise to provide two concentric turns in axially spaced relation and connected by an intermediate portion extending between the ends of the strip, and a contractile spring comprising a strip of metal axially corrugated and interposed between the turns and holding the turns in axially spaced relation, said spring being connected at its ends to the ends of the first-mentioned strip and tending to separate them to expand the turns.

10. A piston ring assembly comprising a strip of metal bent edgewise to provide two concentric turns in axially spaced relation and connected by an intermediate portion extending between the ends of the strip, said ends being formed into loops located between said turns, and a contractile spring comprising a corrugated strip located between said turns and having its ends formed into loops nested within the respective loops of the first-mentioned strip, said contractile spring tending to separate the ends of the first-mentioned strip to expand the turns.

11. A piston ring assembly comprising a strip of metal bent to provide two axially spaced turns connected by an intermediate portion with ends of the strip located in the respective turns adjacent said intermediate portion, and a contractile spring mounted between said turns and connected to the ends of the first-mentioned strip and tending to separate them to expand the turns, the ends of the strips being curled together in face-to-face relation to provide a large area of contact therebetween to sustain the tension of the spring.

12. A piston ring assembly comprising a strip of metal bent edgewise to provide two concentric turns in axially spaced relation and connected by an intermediate portion extending between the ends of the strip, said ends being reversely bent to extend between the turns with the reversely bent portions being corrugated, and a corrugated contractile spring interposed between the turns and having the corrugations adjacent its ends nested in the corrugations of said reversely bent portions, said spring tending to separate the ends of the strip to expand the turns.

13. A piston ring assembly comprising a strip of metal bent edgewise to provide two concentric turns in axially spaced relation and connected by an intermediate portion extending between the ends of the strip, said ends being reversely bent to extend between the turns with the reversely bent portions formed into a series of equally spaced corrugations, and a contractile spring interposed between the turns and having similar corrugations at its ends nested in the corrugations of said reversely bent portions, the corrugations of the spring being shiftable into different corrugations of the strip to vary the tension of the spring.

MACY O. TEETOR.

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