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PISTON RINGS

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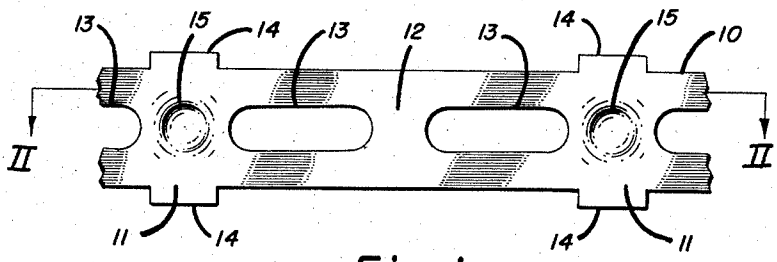


Fig. 1

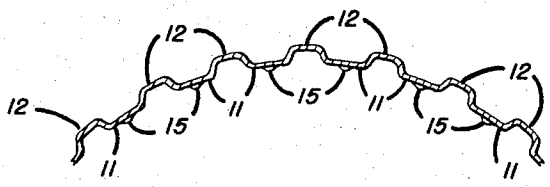


Fig. 2

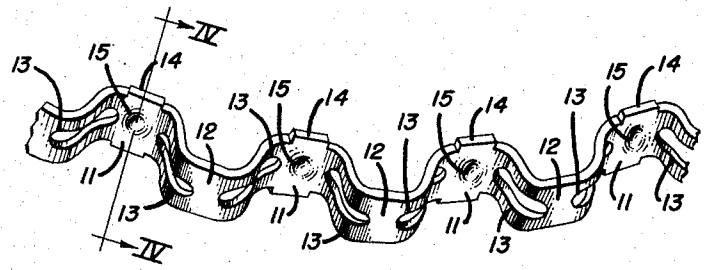


Fig. 3

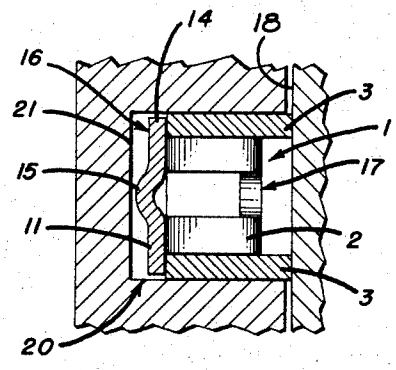


Fig. 4

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PISTON RINGS

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4 Claims. (Cl. 309—45)

This invention relates to piston rings and more particularly to a simple, effective, and inexpensive means for preventing the excessive necklacing of certain types of piston rings at the time of installation. It is specifically adapted to piston rings made entirely of thin metal strip or ribbon or to rings having their spacers made from this type of material.

The problem of controlling necklacing of piston rings at the time of installation has been one that has bothered the piston ring industry for a number of years. Necklacing is the effect produced when the ring is initially installed in the ring groove and as the piston is installed in the cylinler block the ring drops down into the groove on one side with the other side extending out from the groove a corresponding distance. This interferes with the proper centering of the ring as it is installed.

Excessive necklacing may result in breakage of the ring or improper installation resulting in a twisted or warped ring. In either case, the function of the ring is either impaired or destroyed to the detriment of the engine's efficiency.

Necklacing occurs because of the substantially greater depth of the ring groove than the radial depth of the ring. Thus, the ring does not fill the ring groove. In some cases this difference may be substantial but in all cases the ring groove must have a depth greater than the radial depth of the ring to permit the ring to function properly. A number of devices have been developed in the past for the purpose of solving this problem. While these devices have met with reasonable success, they have been comparatively expensive because they normally involve either the manufacture of a separate and additional component for the ring or they have necessitated increasing the radial depth of the ring. Increase in the radial depth of the ring is undesirable, not only because of the added cost but also because of the reduction in flexibility of the ring resulting from the added material. The reduction in flexibility reduces the ring's ability to adapt itself to the cylinder wall and thus form an effective seal.

This invention provides an inexpensive and effective solution to this problem which does not adversely affect the efficiency of the ring or increase its cost.

These and other objects and advantages of this invention will be understood by those acquainted with the design and manufacture of piston rings upon reading the following specification and the accompany drawings.

In the drawings:

Fig. 1 is a fragmentary flat pattern of the blank for the spacer-expander of a piston ring.

Fig. 2 is a fragmentary sectional view of the spacer-expander taken along the plane indicated at II—II in Fig. 1.

Fig. 3 is an oblique fragmentary view of the spacer-expander.

Fig. 4 is a fragmentary enlarged sectional elevation view of a piston ring incorporating this invention installed in the ring groove and compressed in a cylinder.

In executing the objects and purposes of this invention,

there is provided a radially, inwardly, projecting dimple on the radially inner portion of the spacer-expander. The stops are of such height or radial length that they occupy a major portion of the distance between the inner face of the ring and the bottom of the ring groove, thereby preventing the ring from settling deep into the ring groove.

Referring specifically to the drawings, the numeral **1** indicates a piston ring having a spacer-expander **2** and a pair of parted rails **3**, one on each side of the spacer-expander. The spacer-expander **2**, like the rails **3**, is parted at one point.

The spacer-expander is fabricated from certain metals such as stainless steel or a high carbon steel. The strip is passed through suitable dies producing a blank **10** (Fig. 1). The blank consists of inner crown portions **11** alternating with outer crown portions **12**. The connecting portions between the inner and outer crowns forming the sides of the crowns have slots **13**. Each of the inner crowns has both an upwardly and a downwardly extending pad **14**. The central portion of the inner crown is offset inwardly, forming a dimple **15**. The blank illustrated in Fig. 1 is corrugated with the corrugations extending radially inwardly and outwardly of the spacer-expander. After corrugation, the inner crown portions **11** extend toward the radial inner face of the ring while the outer crown portions **12** extend toward the radially outer portion of the ring.

The spacer-expander is assembled with a pair of rails **3** with one rail above and one rail below (Fig. 4). The outwardly extending crowns **12** serve as seats for the rails **3** while the pads **14** serve as a back or inner stop for the rails.

As will be more clearly seen in Fig. 4, the dimple projects radially inwardly from the back of the ring and occupies a portion of the space between the back of the ring and the bottom wall **21** of the ring groove **20**. In so doing, it prevents the ring from moving into the groove to the full depth to which it would otherwise move were the dimple not present. To this extent, it increases the effective radial depth of the ring without increasing the radial depth of the portion of the spacer-expander which controls the character and function of the piston ring. By limiting the ability of the ring to move into the ring groove **20**, it limits the necklacing effect of the ring when it is first installed and, as such, greatly facilitates installation. It also prevents the accidential misalignment, twisting or warpage of the ring due to improper installation as the result of excessive necklacing.

While it increases the effective radial depth of the ring so far as necklacing is concerned, it does not necessitate an increase in the radial depth of the spacer-expander from the back face **16** of the inner crowns to the front face **17** of the outer crowns. This is important because the distance between these two faces is the working or effective radial depth of the ring and controls the ring's functional characteristics such as flexibility. Any increase in this depth in excess of that essential for the stability of the ring is normally not desirable because of the stiffening effect upon the piston ring. The more flexible the ring without sacrifice of required stability, the greater the capacity of the ring to adapt itself to slight variations in the shape of the cylinder wall **18** as the piston reciprocates. Unless the ring is flexible enough to so adapt itself, it will not form the most efficient seal.

By enabling the radial depth of the spacer-expander to be maintained while preventing excessive necklacing, it also permits the radial width of the rails **3** to be kept narrow. This is also important from an operational standpoint because, again, the flexibility of the rails and their capacity to adapt themselves to variations in the

cylinder walls is important in producing an effective seal at all times.

The dimple is formed in the inwardly extending crown where it does not in any way interfere with the ring's operation. It neither strengthens the spacer-expander nor does it weaken it. At the same time, it requires no additional metal for its formation since the dimple is pressed from or formed in the crown and is an integral part of it. Thus, the material cost of the ring is not increased because no additional material is demanded. In fact, it effectively decreases the material cost of the ring in most cases because it eliminates the necessity for the additional part sometimes provided to prevent excessive necklacing.

It also has the desirable feature of not increasing the manufacturing cost of the ring because the dimple may be formed simultaneously with the formation of the blank by the same dies as those used to form the pads **14** or the holes **13**. No additional fabrication operation or handling of the spacer-expander is required.

It will be recognized that while this invention has been described as applied to a particular design for a spacer-expander, its application is not limited to this particular design. It may be applied to any spacer-expander having sufficient material at a plurality of points on its radially inner edge that the dimples can be formed in the material without deformation of the shape of the spacer-expander.

It will be also recognized that while the circular configuration for the dimples illustrated is a particularly satisfactory shape for it because of the ease of forming and the lack of possibility of its formation distorting spacer-expanders even of the most delicate designs, that it is not necessarily limited to this shape. It could just as well be an elongated ridge or it might, in some cases, be a tongue punched out of the crown and turned radially inwardly to serve the same purpose. It is not even necessary that the dimples or their substitutes be applied to each crown. They could be applied to every other crown. However, the closer the spacing the more effective they will be holding the rings way from the back wall **21** of the ring groove the full height of the crown. Each of these are but modifications of the basic invention since they embody the teachings and principles of the invention.

These modifications and others are to be considered as included in the hereinafter appended claims unless these claims by their language expressly state otherwise.

I claim:

1. In a rail supporting member for a piston ring, said rail supporting member having an integral wall portion on its radial inner face, a plurality of radially inwardly projecting spacer elements on said wall portion for spacing said rail supporting member from the bottom of its ring groove to prevent excessive necklacing, the radially inner ends of said spacer elements being smooth for free sliding movement over the bottom of the ring groove.

2. In a piston ring having a rail supporting member formed from thin metal stock, said member having a plurality of circumferentially spaced wall portions on its radial inner face; a radially inwardly projecting dimple formed in each of said wall portions for spacing said piston ring from the bottom of its ring groove; the circle to which said dimples are tangent when said ring is in operating position being greater than the root diameter of the ring groove.

3. In a piston ring having a rail supporting member formed from thin metal stock, said member having a plurality of circumferentially spaced wall portions on its radial inner face; a radially inwardly projecting circular dimple formed in the geometric center of each of said wall portions for spacing said piston ring from the bottom of its ring groove; the circle to which said dimples are tangent when said ring is in operating position being greater than the root diameter of the ring groove.

4. In a piston ring having an integral wall portion on its radial inner face, a plurality of radially inwardly projecting dimples on said wall portion for spacing said piston ring from the bottom of its ring groove to prevent excessive necklacing.

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