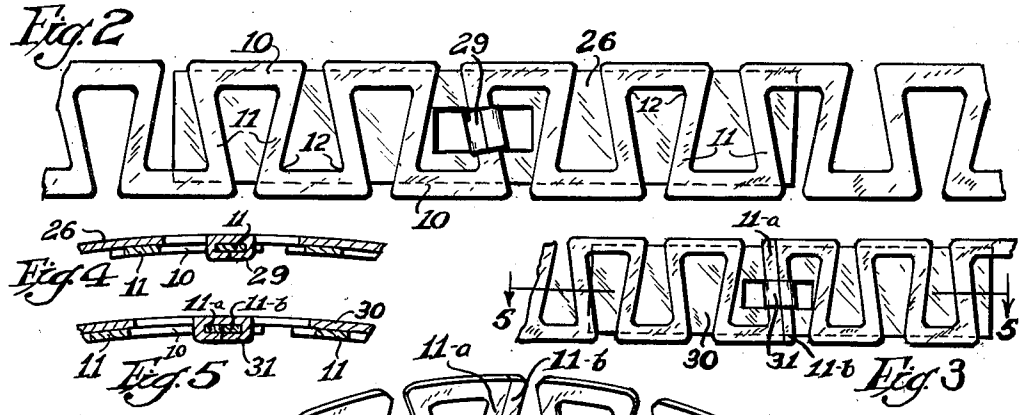
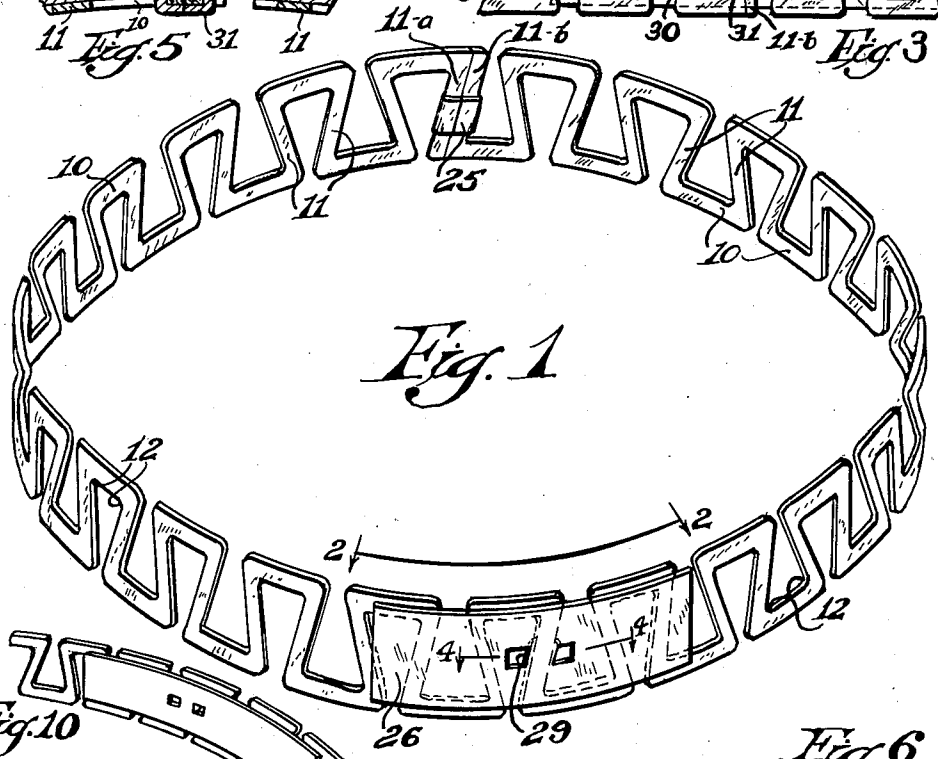
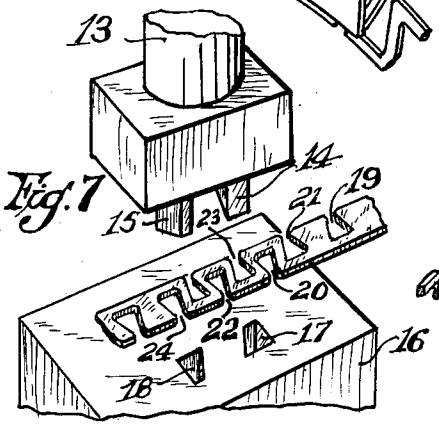
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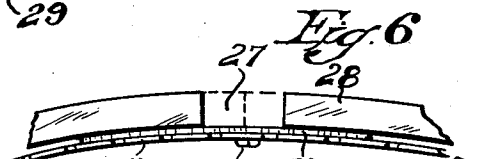
PISTON RING EXPANDER

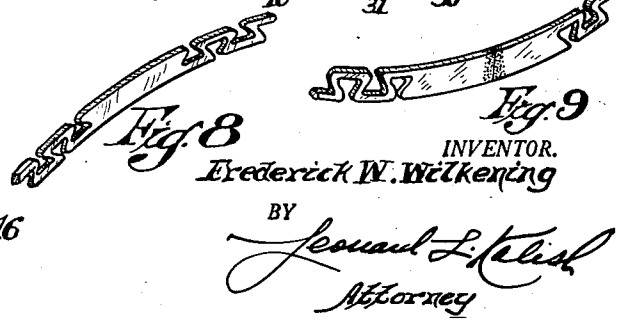
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2,564,744

PISTON-RING EXPANDER

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1 Claim. (Cl. 309—43)

1

The present invention relates to piston-ring assemblies for internal combustion engines or the like and it relates more particularly to a certain new and useful expander for piston-rings.

An object of the present invention is to provide a new and improved piston-ring assembly for internal combustion engines or the like. Another object of the present invention is to provide a new and useful expander for piston-rings. Still another object of the present invention is to provide an improved flexible resilient expander spring or the like for exerting outward tension upon a piston-ring. A further object of the present invention is to provide a simple, inexpensive, efficient and easy-to-install expander for one-piece trans-split piston-rings or the like. Still another object of the present invention is to provide an improved "non-bottoming" expander for a piston-ring.

Other objects and advantages of the present invention are apparent in the following detailed description, appended claim and accompanying drawings.

It has been conventional, in the past, to provide flexible resilient expanders for internally supporting one-piece trans-split piston-rings or the like, whereby the piston-rings (which are themselves relatively non-resilient) are urged radially outward against the cylinder-wall when the piston-ring and expander are installed within the groove of a piston.

However, conventional expanders, as heretofore used, have had the disadvantage of being relatively costly and difficult to install. Accordingly, the present invention contemplates a new and improved expander construction which can be formed from a simple strip of thin flat ribbon steel or the like by simple stamping operations and which can be installed upon a piston, in conjunction with a piston-ring quickly and easily and which will provide uniform outward tension for the piston-ring.

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.

Referring to the accompanying drawings, in which like reference characters indicate like parts throughout:

2

Figure 1 represents a perspective view of one embodiment of the present invention.

Figure 2 represents an elevational view looking generally in the direction of the arrows 2—2.

Figure 3 represents a view generally similar to that of Figure 2 but showing a modified form of the present invention.

Figure 4 represents a cross-sectional view generally along the line 4—4 of Figure 1.

Figure 5 represents a cross-sectional view generally along the line 5—5 of Figure 3.

Figure 6 represents an enlarged fragmentary plan view showing the manner of positioning the embodiment of Figures 3 and 5 within a trans-split piston-ring, preliminary to installing the piston-ring and expander within a cylinder.

Figure 7 represents a more or less schematic perspective view showing the method of forming the corrugated expander member of the present invention.

Figure 8 represents a fragmentary perspective view of still another embodiment of the present invention.

Figure 9 represents a fragmentary perspective view of a modified form of the embodiment of Figure 8.

Figure 10 represents a fragmentary perspective view of a further modified form of the present invention.

In one embodiment of the present invention, shown generally in Figures 1, 2 and 4, I may provide a flexible resilient expander of ribbon steel or the like which is generally axially corrugated and which is formed by generally horizontal portions 10, disposed alternately at the top and bottom edges of the expander and intervening vertical portions 11; successive vertical portions being oppositely inclined so as to form a series of integrally-connected triangular portions open alternately at the top and bottom of the expander.

The inner corners of the triangular portions are preferably rounded as at 12 to permit the triangular portions to be more readily compressed when the expander is installed, as will be described hereinbelow.

While the expander of the present invention can be formed in other ways, I prefer to form it in a manner indicated schematically in Figure 7 wherein a thin flat strip of ribbon steel or the like is passed through a punch-press; the movable part 13 thereof being provided with a pair of oppositely directed keystone-shaped dies 14 and 15. The fixed part 16 of the punch-press 13 is provided with keystone shaped openings 17 and 18 to receive the dies 14 and 15 respectively.

Upon the first punching operation the die 14 forms slot 19 while die 15 forms slot 20 in the ribbon steel "blank." The "blank" is then moved slightly to the right in Figure 7, whereupon the dies 14 and 15 form the slots 21 and 22 respectively on the second punching operation. The "blank" is then again moved to the right, whereupon dies 14 and 15 form the slots 23 and 24 respectively.

It is apparent that on and after the third punching operation, the individual triangular portions will be formed with horizontal portions 10 and inclined vertical portions 11, as described hereinabove.

Any suitable indexing mechanism (not shown) may be provided to insure proper movement of the "blank" between punching operations.

The punching can continue to form a long strip of corrugated ribbon which can then be cut off into appropriate lengths to form individual expanders.

Each individual length can then be formed into a generally continuous annulus by clamping an appropriate metal clip 25 about the juxtaposed free vertical portions or legs 11—*a* and 11—*b*, as indicated particularly in Figure 1.

I also prefer to provide the expander with a saddle or shield or slide 26. The saddle 26 is formed of sheet metal or the like having a transverse dimension slightly less than the axial dimension of the expander and being convexly curved along its longitudinal dimension which is somewhat greater than the gap 27 of the piston-ring 28.

The saddle 26 may be fastened to the expander by striking out therefrom a pair of ears 29 which are bent inwardly and clamped about one of the vertical portions 11, as shown in Figures 1 and 2.

The saddle 26 may be fastened to the expander at any point; the only requirement being that the saddle be positioned at the gap of a piston-ring, in a manner similar to that shown in Figure 6, when the piston-ring and expander are installed upon a piston and within a cylinder.

The saddle is important for ease of installation of the piston-ring and expander in that it prevents the expander from bulging out through the gap 27 of the piston-ring 28 when the piston-ring is collapsed into the groove of a piston. That is, if the saddle is omitted, there is a tendency on the part of the expander to bulge out between the free ends of the piston-ring and to get caught therebetween when the piston-ring is collapsed unless the mechanic is extremely careful. With the saddle, properly positioned at the gap 27 of the piston-ring 28, on the other hand, there is no tendency for the expander to bulge out into the gap, and accordingly, the installation of the piston-ring and expander can be accomplished much more quickly and easily.

In Figures 3, 5 and 6 I have shown a modified form of the present invention wherein the saddle or shield 40 also serves as the clip for holding the ends of the expander together.

Thus, the saddle 30 is provided with a pair of ears 31 which are somewhat longer than the ears 29 described above and which can be bent inwardly and clamped about the juxtaposed free vertical portions or legs 11—*a* and 11—*b*.

In assembling the piston-ring and expander, the saddle 30 is placed at the gap 27 of the piston-ring 28, as shown in Figure 6, after which the piston-ring is compressed to close the gap and to collapse the ring-and-expander assembly into the groove of a piston, whereby the expander will

exert outward tension upon the ring when installed within a cylinder.

It is obvious, therefore, that the saddle 30 performs the dual function of holding the ends of the expander together (so as to provide a more or less continuous annulus) and of preventing the expander from bulging out between the free ends of the piston-ring during installation of the ring-and-expander assembly.

In Figure 8 there is shown a further modified form of the present invention wherein the saddle is formed integrally with the expander. That is, a portion of the expander is left unperforated and uncorrugated so that, when positioned at the gap of the piston ring, it will prevent bulging out of the expander during compression of the piston-ring or expander within a piston-groove for installation in a cylinder. The unperforated portion of the expander may be an intermediate portion as shown in Figure 8, or, instead, may be at the end portions of the expander as shown in Figure 9.

That is, in Figure 9, the perforations terminate short of the end of the expander and the unperforated end-portions are butt-welded or otherwise permanently joined to form a generally continuous annulus. Instead of butt-welding, other fastening means can be employed for the ends of the embodiment shown in Figure 9.

It is obvious that the embodiments described hereinabove can be further modified without departing from the spirit of the present invention.

That is, it is possible to use the expander of the present invention with multiple-piece piston-rings (for example, with piston-rings made up of two or more axially-disposed annuli).

It is also possible to eliminate the rounded inner corners shown in the drawings and, instead, to employ sharp corners.

The clip which connects the free ends of the expander can be fastened so as permanently to connect the free ends, or, instead, the clip can be so arranged that one or both of the free ends can be slipped out therefrom. This latter form may be preferred under certain circumstances, inasmuch as it permits the expander more easily to be fitted around the piston-groove during installation.

Instead of forming the expander in the manner indicated in Figure 7, it is possible to form the expander in other ways. Thus, for example, it is possible to employ a relatively large number of closely adjacent oppositely-directed keystone-shaped dies so that a number of perforations or slots can be made in a single punching operation, after which the strip can be moved, and the multiple punching operation repeated.

It is also possible, instead of stamping the expander from a sheet metal "blank," to form it from a wire or the like (of appropriate cross-section) by a series of continuous reverse-bend or corrugating operations.

Instead of the type of corrugation or bending shown in the drawings, it is possible to construct the expander of the present invention with other types of corrugations or bends. For example, instead of having each of the bends formed at an acute angle, they can be formed at an obtuse angle. Similarly, instead of being sharply angular, the bends can be relatively smoothly curved.

While, for simplicity of construction, the saddle protrudes outwardly from the expander a few thousandths of an inch, as indicated in Figure 6, it is possible to form a slight recess or depression in the outer surface of the expander at the point at

which the saddle is to be installed so that the saddle is more nearly flush with the outer surface of the expander.

The expander of the present invention not only provides a simple, inexpensive construction for resiliently expanding a piston-ring or the like, but also eliminates the need for the expander "bottoming" against the rear or inner wall of the piston-groove.

That is, in the conventional type of radially-corrugated expander shown, for example, in my Patent 1,911,735, the expander must make contact, as spaced intervals, with the back or radially-innermost wall of the piston-groove, in order to provide resilient support for the piston-ring. In the construction of the present invention, on the other hand, the expander forms a complete, more or less continuous resilient annulus which is compressed slightly upon itself during installation of the piston-ring and expander within a piston, so that its inherent resilience urges the piston-ring outwardly without need for "bottoming" against the inner or back wall of the piston groove. This eliminates the need for accurately dimensioning the thickness or radial dimension of the piston-ring in accordance with the depth of the piston-groove. In other words, it is apparent that the conventional radially-corrugated expander will not function properly unless the radial dimension of the piston-ring is accurately engineered to fit the piston-groove, since otherwise there will be too little or too great pressure exerted by the expander upon the ring. With the present expander, on the other hand, it is necessary only to engineer the rings for flexibility; there being no need for considering the depth of the piston-groove.

Instead of positioning the shield or saddle of the present invention on the outside of the expander (that is, intermediate the expander and the piston-ring as shown in Figure 6), it is possible to place the shield or saddle on the inside of the expander as shown, for example, in Figure 10. That is, it is apparent that the shield or saddle would tend to bridge the gap of the piston-ring and to prevent bulging out of the expander, whether the shield or saddle is disposed on the inside or the outside of the expander. This inwardly-disposed shield could be positioned at the free ends of the expander so as to serve as a fastening clip, in the manner indicated in Figure 3, or at any other point of the expander, as, for example, in a position corresponding to that shown in Figures 1 and 2. It is apparent that, with this inwardly-positioned saddle or shield, Figures 2 and 3 would represent elevational views looking from the outside of the expander and that the fastening ears would be struck out toward the convex side of the shield or saddle, as shown in Figure 10, rather than toward the concave side, as shown in Figures 4 and 5.

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 claim rather than to the foregoing description to indicate the scope of the invention.

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

An expander for a piston-ring or the like, said expander comprising a more or less continuous highly flexible annulus of thin flat resilient metal or the like, said annulus being axially corrugated thereby to provide a series of horizontal portions disposed alternately at the top and bottom of the ring and intervening vertical portions formed integrally with said horizontal portions, successive vertical portions being inclined oppositely, thereby to provide a series of circumferentially-distributed generally triangular segments, successive segments being open alternately at the top and bottom of said expander, and a relatively form-retaining shield of thin flat sheet metal or the like disposed generally in juxtaposed relationship to said expander and provided with clamping ears fastening together the free vertical end portions of said expander, said shield being adapted to be positioned adjacent the gap of a transplit piston-ring thereby to prevent said expander from bulging out into the gap when said ring and expander are compressed within a piston-groove for installation in a cylinder.

FREDERICK W. WILKENING.

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