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C. R. SHORT

2,061,780

PISTON RING AND PROCESS OF PRODUCING SAME

Filed July 16, 1923

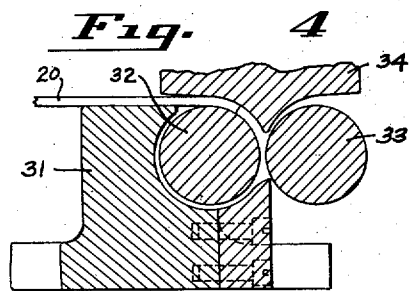
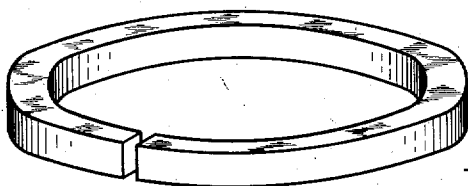
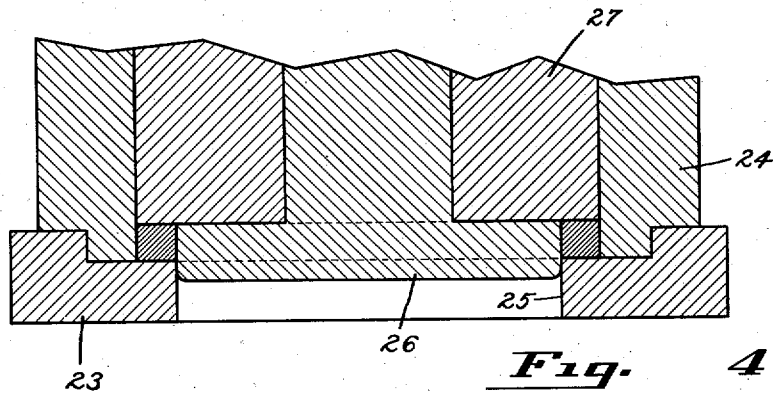
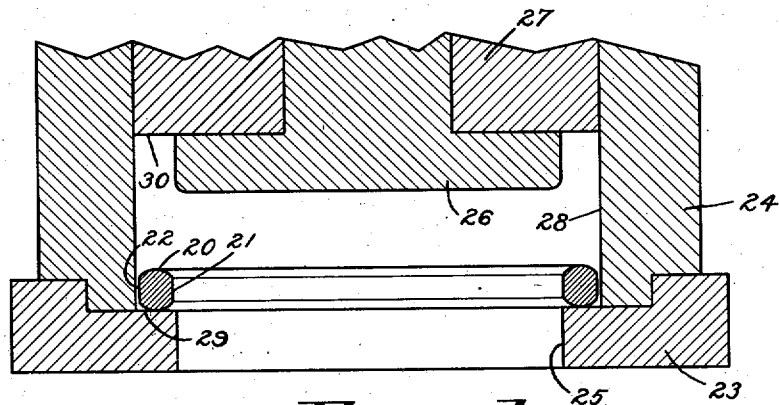
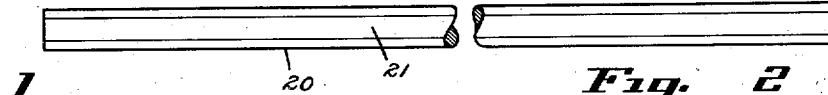
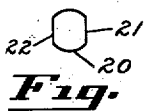


Fig. 5

Fig. 6

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UNITED STATES PATENT OFFICE

2,061,780

PISTON RING AND PROCESS OF
PRODUCING SAME

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mesne assignments, to General Motors Corpo-
ration, Detroit, Mich., a corporation of Dela-
ware

Application July 16, 1923, Serial No. 651,687

34 Claims. (Cl. 29—156.6)

This invention relates to improvements in packing rings, particularly, packing rings for the pistons of internal combustion engines, and, also, to the method of making the same.

5 It is among the objects of the present invention to simplify the process of making piston packing rings so that the cost of producing the same, both in time and labor, will be substantially reduced.

10 It is another object of the invention to simplify the process of making piston packing rings so that it will lend itself to the use of automatic machinery which is capable of producing a finished ring from raw stock without additional operations.

15 Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing wherein a preferred form of the invention is clearly illustrated.

20 In the drawing:

Figs. 1 and 2 are, respectively, end and side elevations of a piece of stock, with flat sides produced by the preliminary rolling operation.

25 Fig. 3 is a sectional view showing the stock in position in the die before the pressing operation.

30 Fig. 4 is a view similar to Fig. 3, but showing the stock after the pressing operation has been completed.

Fig. 5 is a perspective view of the completed piston ring.

35 Figure 6 is a view illustrating more or less diagrammatically apparatus for and the operation of simultaneously reshaping the stock and bending it into ring form.

In making a piston ring by the present method, the stock, which may be a round rod of fairly high carbon steel, is given an initial rolling for a purpose to be indicated. This initial treatment provides the stock, designated by the numeral 20, with two oppositely disposed flat sides 21 and 22, as is clearly illustrated in Figs. 1 and 2. Such a rolling to some extent
40 breaks down the normal grain structure of the steel due to the stress exerted by the rolls on the material and the "slip bands", as they are commonly called of which the grains are composed, will be shifted both longitudinally and,
45 to some extent, laterally. As is well known in the art, the breaking down of the grains and shifting of the slip bands provides an increased amount of intergranular amorphous cement as well as an increased superficial area of the
50 grains which alters the inherent characteristics

of the metal so treated. Such an increase of the cement acting upon a greater extent of surface will cause the metal to become comparatively harder and more resilient. Longitudinal rolling, as is proposed in the initial treatment
5 of the rolled stock, will tend to cause lengthwise distortion and slipping of the slip bands, thereby tending to provide the resilience required in piston rings.

Before the stock can be inserted in the die
10 for the pressing step, it must be bent into ring form. This can be done concomitantly with the rolling of the two flat sides 21 and 22 or it may be done by a separate operation. The piece of stock from which it is intended to form the ring
15 may be severed from the main supply either after it has been bent into ring form or previous thereto depending, of course, upon the method by which it is bent. The length of the piece of stock from which the ring is to be made is
20 somewhat shorter than the circumferential length of the completed ring, due to the fact that during the pressing operation there will be sufficient longitudinal displacement of the grains of the metal to cause some elongation
25 and the ends of the stock to approach each other and substantially meet.

In Figure 6 there is illustrated more or less diagrammatically apparatus for simultaneously
30 reshaping the stock and bending it into ring form. The apparatus consists of a frame or support 31, on which are mounted rollers 32 and 33, and a guide element 34. To reshape the stock in cross-section, to increase its hardness, toughness and resiliency and simultaneously to
35 bend it into ring form, an end of the stock is inserted into the space between the roller 32 and the guide 34. Rotation of the rollers 32 and 33 will then cause the stock to be drawn between the rollers which will reshape it in
40 cross section and harden, toughen and make it more resilient. During this operation, the stock is bent around the roller 32, and since, in being so bent, it is strained beyond its elastic limit, will remain in ring form after it has been
45 freed from the rollers.

After the piece of stock has been bent into circular form, so that the flat sides form the inner and outer peripheries of the ring, it is inserted in a die substantially of the form shown.
50 This die comprises a base 23 having a circular shell 24 mounted upon and secured thereto in any suitable manner. The base 23 has a central opening 25 which forms a receptacle for the pilot member 26 of the male element 27 of the
55

die. The inside wall 28 of the shell 24 is of a greater diameter than the opening 25 so that a shelf 29 is provided and upon this shelf the piece of stock 20 now in circular form is adapted to rest. As is shown in Figs. 3 and 4, when the male element 27 of the die moves downwardly, the pilot member 26, being of substantially the same diameter as the opening 25, will pass into and through the circular piece of stock 20 and enter the opening 25 in the base 23. The outer flat side designated by the numeral 22 will be adjacent the inner wall of the shell 24, while the inner flat side 21 of the stock 20 will be adjacent the outer surface of the pilot 26. The continued downward movement of the male element 27 will cause the lower surface 30 thereof to engage with the upper portion of the ring 20 and, upon still further movement thereof, the grain structure of the metal will be broken down, causing portions of the metal to flow laterally to fill up the space between the stock and the interior of the die, while another portion of the metal will flow longitudinally of the ring causing the ends of the ring to approach each other and substantially meet.

In Fig. 4, the various elements of the die are shown in the positions in which they are located after the pressing step has been completed, and the ring is shown in the shape to which it is deformed during the operation. In Fig. 5, there is shown the completed ring after it has been removed from the die.

While the embodiment of the present invention herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What I claim is as follows:

1. The process of producing piston rings for internal combustion engines which comprises treating the stock of which the ring is to be made so that the slip bands of the grains thereof will be caused to be displaced longitudinally; bending the stock into circular form; then treating the same so that the slip bands will be displaced, laterally.

2. The process of producing piston rings for internal combustion engines which comprises treating the stock of which the ring is to be made so that the slip bands of the grains thereof will be caused to be displaced longitudinally; bending a piece of stock thus treated, which is somewhat shorter than the circumference of the finished ring into circular form; then treating this circular shaped piece to cause the slip bands thereof to be displaced laterally and also to some extent longitudinally.

3. The process of producing piston rings for internal combustion engines which comprises rolling the stock of which the ring is to be made so that the slip bands of the grains thereof will be caused to be displaced longitudinally; then cutting the stock shorter than the desired circumferential length of the ring and bending the same into circular form, then by die pressing causing the slip bands thereof to be displaced laterally and also to some extent longitudinally, so that the ends of the ring will approach each other.

4. The process of producing piston rings for internal combustion engines which comprises taking a piece of stock, provided with two opposite flat surfaces and two opposed rounded surfaces, bending the piece into circular form so that one flat side will form the inner periphery and

the other flat side forms the outer periphery; then pressing the same in a die to displace the metal and form a ring having its body substantially rectangular in section.

5. The process of producing piston rings for internal combustion engines which comprises rolling round stock to provide two flat sides oppositely disposed; cutting off the proper lengths and forming these lengths into circular shape so that the flat sides form the inner and outer peripheries of the ring, then working the metal of the ring so that the body thereof will be substantially rectangular in cross section.

6. The process of producing piston rings for internal combustion engines which comprises rolling round stock to provide two flat sides oppositely disposed and at the same time forming a ring with the flat sides to the inside and outside thereof; cutting off the flattened stock; then pressing the ring in a die to give the body thereof a rectangular cross section.

7. The process of producing piston rings for internal combustion engines which comprises rolling round stock so that two opposite flat sides are provided and the stock assumes a circular form; cutting off this rolled stock in lengths shorter than the desired circumferential length of the finished ring; then placing the ring in a forming die and causing the metal of the ring to be shaped substantially rectangular in cross section by the displacement of metal.

8. The process of producing piston rings for internal combustion engines which comprises rolling round stock so that two opposite flat sides are provided and the stock assumes a ring-like form; cutting the so formed stock into curved lengths shorter than the desired circumferential length of the finished curved length of stock; then placing the ring in a forming die and causing lateral and longitudinal displacement of metal, the former causing the body of the ring to assume a rectangular form in cross section while the latter causes the ends of the ring to approach each other.

9. A process of making piston rings which consists in producing a ring-like metallic blank of non-rectangular cross section and deforming said blank by pressure into a ring of a substantially rectangular cross section.

10. A process of making piston rings which consists in elongating a piece of metal stock by causing the particles thereof to flow longitudinally, thereby changing the cross sectional contour of the stock, and then compressing the stock in such manner as to cause particles thereof to flow transversely and again change the cross sectional contour of the stock.

11. A process of making piston rings which consists in elongating a piece of metallic stock by causing the particles thereof to flow longitudinally, forming the so treated stock into a ring-like body and then compressing said ring-like body by pressure applied axially thereof, thereby causing a lateral flow of a substantial portion of the metallic particles of the body, thereby again changing the cross sectional contour.

12. A piston ring of which the inner and outer surfaces have a structure characteristic of that produced by longitudinal displacement, and the upper and lower surfaces a structure produced by lateral displacement of metal.

13. The method of making a piston ring which consists in taking a piece of rod-like stock, bending it to the approximate shape of a piston ring,

and forming it to substantially finished shape and size by the application of heavy pressure.

14. The method of making piston rings which consists in rolling a strip of material to cause it to approximate the finished article in cross section, and forming the strip into a ring, and forming the ring to substantially the shape and size of the finished article by the application of pressure.

15. The method of making a piston ring which consists in taking a piece of rod-like stock, rolling the stock to effect reshaping of it in cross section and at the same time imparting increased hardness and resilience to the metal, bending the stock to ring like form, and subjecting it to heavy pressure in a suitable die to cause the ring to assume substantially finished shape and dimensions.

16. That process of making strong, tough and durable split packing rings capable of sliding in contact with the inner surface of a cylinder wall without scoring the latter which comprises as steps, bending a length of metal to form a ring, and flattening one of the axial faces of the ring.

17. That process of making strong, tough and durable split packing rings capable of sliding in contact with the inner surface of a cylinder wall without scoring the latter which comprises as steps, bending a length of metal to form a ring, and subjecting the ring while circumferentially confined to axial pressure.

18. That process of making tough, strong and durable split packing rings capable of sliding in contact with the inner surface of a cylinder wall without scoring the latter which comprises, bending a rod of steel to form a ring, confining the ring within a space having substantially the circumferential contour and radial cross section of the desired finished ring, and subjecting the ring while so confined to axial pressure.

19. The method of making a piston ring which consists of rolling a piece of steel rod to effect reshaping of it in cross section and at the same time imparting increased hardness and resilience to the metal, bending the rod to ring-like form, and subjecting it to heavy pressure in a suitable die to cause the ring to assume substantially finished shape and dimensions.

20. That process of making radially expandable split packing rings which comprises as steps bending a length of wire or rod of a strong, tough and durable material capable of sliding in contact with the inner surface of a cast-iron cylinder wall under normal working conditions without scoring the wall to form a single substantially plane annular turn having a gap at one point, and severing said turn from the length of material.

21. That process of making strong, tough and durable radially expandable split packing rings capable of sliding in contact with the inner surface of a cylinder wall under normal working conditions without scoring the wall, which comprises as steps bending a length of hard steel wire to form a split ring of substantially the desired peripheral contour, and subjecting the ring, while circumferentially confined, to axial pressure to flatten its radial faces and reduce it to the desired radial cross section.

22. That process of making strong, tough and durable radially expandable split packing rings capable of sliding in contact with the inner surface of a cylinder wall under normal working conditions without scoring the wall, which comprises as steps bending a length of hard steel rod

or wire, of approximately the cross section of the desired packing, to form a split ring of substantially the desired peripheral contour, disposing the ring within a template member having an opening therethrough whose inner contour is a substantial replica of the outer contour of the finished ring, placing an inner template member, whose outer contour is a substantial replica of the inner contour of the finished ring, within the ring, placing the template members with the ring confined between them between parallel platen surfaces of a press, and causing said platen surfaces to approach and thereby to flatten the radial faces of the ring.

23. That process of making strong, tough and durable radially expandable split packing rings capable of sliding in contact with the inner surface of a cylinder wall under normal working conditions without scoring the wall, which comprises preparing a length of hard steel slightly shorter than the circumferential length of the desired ring and slightly thicker in an axial direction than the finished ring, bending said length of material to form a split, radially expandable ring, confining said ring within a space having substantially the circumferential contour and radial cross section of the desired finished ring, and subjecting the ring while so confined to axial pressure whereby to flatten its radial faces and to cause the ring to elongate circumferentially to its final dimensions.

24. That process of making strong, tough and durable radially expandable split packing rings capable of sliding in contact with the inner surface of the cylinder wall under normal working conditions without scoring the wall, which comprises as steps bending a length of hard steel to form a split radially expandable ring, confining said ring in a groove having spaced circumferential walls corresponding respectively to the desired shape of the inner and outer peripheral surfaces of the desired packing, and subjecting the ring while so confined to axial pressure to cause the metal of the ring to flow into contact with the opposed walls of said groove and simultaneously to shape the radial faces of the packing ring.

25. That process of making split packing rings adapted to slide in contact with the inner surface of a cylinder wall which comprises bending a length of high carbon steel to form an annular turn, and shaping the turn by subjecting it to axial pressure.

26. That process of making radially expandable split packing rings adapted to slide in contact with the inner surface of a cylinder wall, which comprises as steps, bending a length of high carbon steel to form a split radially expandable ring of approximately the desired contour, and flattening the radial faces of the ring by axial pressure to reduce the ring to its final axial thickness.

27. That process of making radially expandable split packing rings adapted to slide in contact with the inner surface of a cylinder wall which comprises as steps, bending a length of high carbon steel wire to form a split ring of substantially the desired peripheral contour, and subjecting the ring while confined circumferentially both internally and externally to pressure to reduce it to its final cross section.

28. That process of making piston packings which comprises as steps bending a length of high carbon steel rod or wire of approximately the cross section of the desired packing to form a split ring of substantially the desired peripheral

eral contour, disposing the ring within a template member having an opening therethrough whose inner contour is substantially a replica of the outer contour of the finished ring and subjecting the ring within the template member to axial pressure to flatten its end faces.

29. That process of making radially expansible split packing rings adapted to slide in contact with the inner surface of a cylinder wall, which comprises as steps, bending a length of high carbon steel rod or wire of approximately the cross section of the desired packing to form a split ring of substantially the desired peripheral contour, disposing the ring within a template member having an opening therethrough whose inner contour is a substantial replica of the outer contour of the finished ring, placing an inner template member, whose outer contour is a substantial replica of the inner contour of the finished ring, placing the template members with the ring confined between them between parallel platen surfaces of a press, and causing said platen surfaces to approach and thereby to flatten the radial faces of the ring.

30. That process of making strong, tough and durable radially expansible split packing rings capable of sliding in contact with the inner surface of a cast iron cylinder wall under normal working conditions without scoring the wall, which comprises as steps bending a length of high carbon steel of desired transverse section to form a single substantially plane annular turn, and severing the turn from the length of material to form a ring having a gap at one point.

31. That process of making strong, tough and durable radially expansible split packing rings capable of sliding in contact with the inner surface of a cylinder wall under normal working conditions without scoring the wall, which comprises as steps bending a length of wire of hard high carbon steel to form a split ring of substantially the desired peripheral contour and subjecting the ring, while circumferentially confined, to axial pressure to flatten its radial faces and reduce it to the desired radial cross section.

32. That process of making strong, tough and durable radially expansible split packing rings capable of sliding in contact with the inner surface of a cylinder wall under normal working conditions without scoring the wall, which comprises as steps bending a length of rod or wire of hard

high carbon steel of approximately the cross section of the desired packing, to form a split ring of substantially the desired peripheral contour, disposing the ring within a template member having an opening therethrough whose inner contour is a substantial replica of the outer contour of the finished ring, placing an inner template member, whose outer contour is a substantial replica of the inner contour of the finished ring, within the ring, placing the template members with the ring confined between them between parallel platen surfaces of a press, and causing said platen surfaces to approach and thereby to flatten the radial faces of the ring.

33. That process of making strong, tough and durable radially expansible split packing rings capable of sliding in contact with the inner surface of a cylinder wall under normal working conditions without scoring the wall, which comprises preparing a length of hard high carbon steel slightly shorter than the circumferential length of the desired ring and slightly thicker in an axial direction than the finished ring, bending said length of material to form a split, radially expansible ring, confining said ring within a space having substantially the circumferential contour and radial cross section of the desired finished ring, and subjecting the ring while so confined to axial pressure whereby to flatten its radial faces and to cause the ring to elongate circumferentially to its final dimensions.

34. That process of making strong, tough and durable radially expansible split packing rings capable of sliding in contact with the inner surface of a cylinder wall under normal working conditions without scoring the wall, which comprises as steps bending a length of hard high carbon steel to form a split radially expansible ring, confining said ring in a groove having spaced circumferential walls corresponding respectively to the desired shape of the inner and outer peripheral surfaces of the desired packing, and subjecting the ring while so confined to axial pressure to cause the metal of the ring to flow into contact with the opposed walls of said groove and simultaneously to shape the radial faces of the packing ring.

CHARLES R. SHORT.

CERTIFICATE OF CORRECTION.

Patent No. 2,061,780.

November 24, 1936.

CHARLES R. SHORT.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, first column, line 4, for the article "the" first occurrence, read a; page 2, second column, lines 38 and 39, claim 8, for the words "curved length of stock; then placing the ring" read ring; then placing the curved length of stock; page 3, first column, line 6, claim 14, strike out "and" first occurrence; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 30th day of March, A. D. 1937.

Henry Van Arsdale

Acting Commissioner of Patents.

(Seal)

eral contour, disposing the ring within a template member having an opening therethrough whose inner contour is substantially a replica of the outer contour of the finished ring and subjecting the ring within the template member to axial pressure to flatten its end faces.

29. That process of making radially expansible split packing rings adapted to slide in contact with the inner surface of a cylinder wall, which comprises as steps, bending a length of high carbon steel rod or wire of approximately the cross section of the desired packing to form a split ring of substantially the desired peripheral contour, disposing the ring within a template member having an opening therethrough whose inner contour is a substantial replica of the outer contour of the finished ring, placing an inner template member, whose outer contour is a substantial replica of the inner contour of the finished ring, placing the template members with the ring confined between them between parallel platen surfaces of a press, and causing said platen surfaces to approach and thereby to flatten the radial faces of the ring.

30. That process of making strong, tough and durable radially expansible split packing rings capable of sliding in contact with the inner surface of a cast iron cylinder wall under normal working conditions without scoring the wall, which comprises as steps bending a length of high carbon steel of desired transverse section to form a single substantially plane annular turn, and severing the turn from the length of material to form a ring having a gap at one point.

31. That process of making strong, tough and durable radially expansible split packing rings capable of sliding in contact with the inner surface of a cylinder wall under normal working conditions without scoring the wall, which comprises as steps bending a length of wire of hard high carbon steel to form a split ring of substantially the desired peripheral contour and subjecting the ring, while circumferentially confined, to axial pressure to flatten its radial faces and reduce it to the desired radial cross section.

32. That process of making strong, tough and durable radially expansible split packing rings capable of sliding in contact with the inner surface of a cylinder wall under normal working conditions without scoring the wall, which comprises as steps bending a length of rod or wire of hard

high carbon steel of approximately the cross section of the desired packing, to form a split ring of substantially the desired peripheral contour, disposing the ring within a template member having an opening therethrough whose inner contour is a substantial replica of the outer contour of the finished ring, placing an inner template member, whose outer contour is a substantial replica of the inner contour of the finished ring, within the ring, placing the template members with the ring confined between them between parallel platen surfaces of a press, and causing said platen surfaces to approach and thereby to flatten the radial faces of the ring.

33. That process of making strong, tough and durable radially expansible split packing rings capable of sliding in contact with the inner surface of a cylinder wall under normal working conditions without scoring the wall, which comprises preparing a length of hard high carbon steel slightly shorter than the circumferential length of the desired ring and slightly thicker in an axial direction than the finished ring, bending said length of material to form a split, radially expansible ring, confining said ring within a space having substantially the circumferential contour and radial cross section of the desired finished ring, and subjecting the ring while so confined to axial pressure whereby to flatten its radial faces and to cause the ring to elongate circumferentially to its final dimensions.

34. That process of making strong, tough and durable radially expansible split packing rings capable of sliding in contact with the inner surface of a cylinder wall under normal working conditions without scoring the wall, which comprises as steps bending a length of hard high carbon steel to form a split radially expansible ring, confining said ring in a groove having spaced circumferential walls corresponding respectively to the desired shape of the inner and outer peripheral surfaces of the desired packing, and subjecting the ring while so confined to axial pressure to cause the metal of the ring to flow into contact with the opposed walls of said groove and simultaneously to shape the radial faces of the packing ring.

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Henry Van Arsdale

Acting Commissioner of Patents.

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