Nov. 11, 1924. 1,515,472

H. S. FRANK

PROCESS OF MAKING PISTON RINGS

Filed Sept. 16, 1920

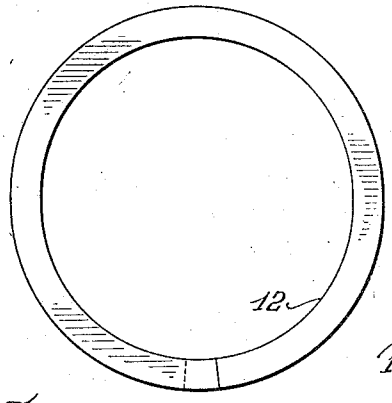


Fig. 1.

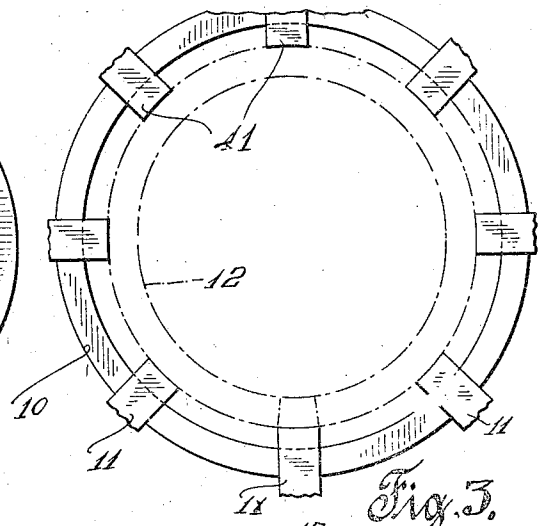


Fig. 3.

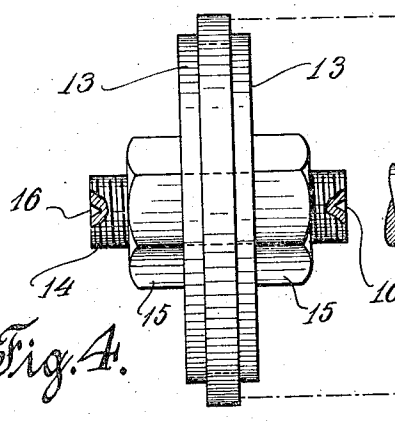


Fig. 4.

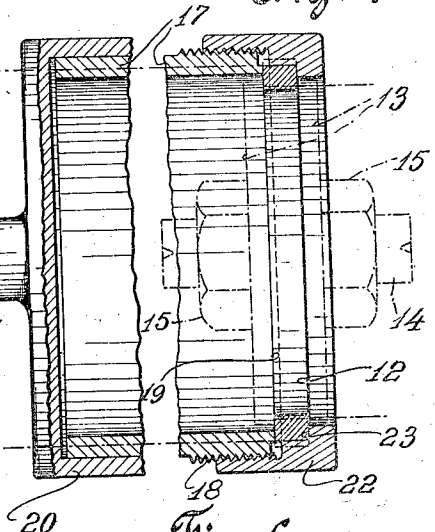


Fig. 6.

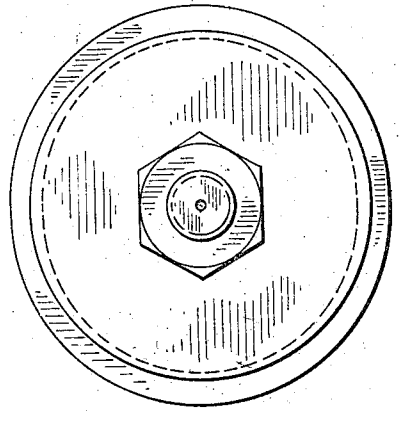


Fig. 5.

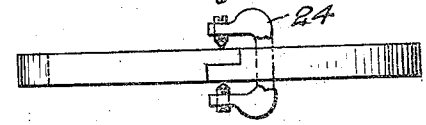


Fig. 2.

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By his Attorney
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UNITED STATES PATENT OFFICE.

HARRY S. FRANK, OF WOODMERE, NEW YORK.

PROCESS OF MAKING PISTON RINGS.

Application filed September 16, 1920. Serial No. 410,620.

To all whom it may concern:

Be it known that I, HARRY S. FRANK, a citizen of the United States, and resident of Woodmere, L. I., in the county of Nassau and State of New York, have invented certain new and useful Improvements in Processes of Making Piston Rings, of which the following is a specification.

This invention relates in general to the process of making piston rings and particularly to a method of producing uniformly expanding rings similar to that set forth in my United States application, Serial No. 325,711 filed September, 1919.

Its primary object is to provide an effective and comparatively inexpensive novel process of producing piston rings which will uniformly expand at all points of their circumference, and therefore afford a perfect, tight fit within the cylinder wall for which they are intended, thus exerting an equal radial outward pressure at all points of their peripheries against the cylinder wall.

The foregoing and a number of other important objects will be readily disclosed and understood from the following description and the accompanying drawings, serving for explanatory purposes, in which:

Figure 1 represents a concentric, gapped ring blank in closed, freely assumed shape.

Figure 2 illustrates how theoretically a ring is clamped together at its gap, thus permitting it to freely assume a natural ring-like shape.

Figure 3 is a diagrammatical illustration of a device for temporarily receiving a ring blank and facilitating its freely assuming a ring-like shape and with its radial expanding force in equilibrium.

Figure 4 is a side elevation of a clamping and centering device for retaining the ring in its originally assumed natural shape and facilitating the reducing of the ring's outer circumference to a true circle of desired diameter.

Figure 5 is a plan view thereof.

Figure 6 is a cross sectional view of a reclamping and centering device for retaining the outwardly reduced ring in its originally closed shape and facilitating the ring's inner circumference being turned to desired dimension.

In Figure 3 a receiver 10 is diagrammatically shown in which is mounted a plurality of radially movable blocks 11. Only a small number of these blocks is illustrated but this will suffice for explaining the working principle of the device.

A severed or gapped ring 12, fixedly held together at its ends is placed into the receiver and the blocks are gradually moved inward until abutting with the ring's outer circumference. Now the ring ends are freed, while blocks 11 are holding the ring in the exact shape as that when the ring was originally introduced while held together at its ends.

In quantity manufacture it was found that a large percentage of rings of the like sizes will assume the like curvatures when closed at and fixedly held together at their ends. For such rings of equal sizes, receivers with permanently attached ribs or blocks 11 can be used.

When a plurality of such rings of equal size and equal curvature have been placed into the receiver, a clamping device, shown in Fig. 4, is introduced into the receiver, and the rings are fixedly clamped together while retaining the shape which they freely assumed, when originally held together at their ends. This clamping device as shown comprises disks or washers 13, through the center opening of which passes a threaded centering spindle 14. Nuts 15 serve for tightening disks 13 against the faces of the ring.

When introducing the clamping device into the receiver, it is obvious that before clamping the ring the device must be first centered in the receiver. The centering spindle 14 is provided with any suitable centering means indicated at 16, by means of which it may be held in a machine, for instance, in a lathe, milling machine, grinder or the like.

When correctly centered, the ring 12 is now turned or otherwise reduced at its outer circumference to a true circle of the desired diameter for which the ring is intended.

Thereafter the reduced ring, without having been released from its originally assumed shape, is placed and centered in another clamping contrivance shown in Fig. 6, which I will term a re-clamping device. It consists of a tubular member 17, externally threaded at one of its ends 18 and provided with a flat annular seat 19. The other end of the re-clamping device is pref-

erably smooth and fits into a socket 20 provided with a centering stem 21. Engaging the threaded end 18 of sleeve or tubular member 17 is an open cap 22 provided with an annular seat 23.

Before attaching the cap, the centering device (shown in Fig. 4) holding ring 12 is placed bodily into sleeve 17 so that one face of the ring abuts with face or seat 19 of the sleeve. The ring is then properly centered and the cap is screwed on the sleeve until face 23 firmly clamps the ring in position.

Now the nuts 15 of the clamping device are loosened and disks 13 removed. The sleeve is then centered in socket 20 and the inner circumference of the ring is machined to the desired dimensions.

It is obvious that the above operations may be reversed in so far as it is more expeditious to first center the receiver shown in Fig. 3, into which a ring was placed in the manner stated above, bore the ring's inner circumference and then transfer it to an arbor similar to that shown in Fig. 4 and finish its outer circumference, while held in the arbor.

Where a number of rings of the same curvature are retained in a receiver, their inner and outer surfaces may be machined in multiple in the same manner.

Before the ring is turned, it will be advantageous to roughly face the ring, but this operation may be done when the ring is already closed. The finishing and facing of the ring may take place when the ring is released after the machining operations.

I have found it sometimes preferable to roughly finish the ring blank before turning it to desired diameter. Also roughly cutting or gapping it and later finishing the gapped ends may prove of benefit in some cases.

In Fig. 2 a temporary clamping device 24 of simple construction is shown to indicate that the closing of the gapped ring may be accomplished in any desired manner as long as the closing operation of the ring is unobstructed in any way, thus allowing the ring to freely assume a so to speak natural shape, whereby an equilibrium of its radial expanding forces is established.

In order to simplify and to reduce my process to practical shop operations a variety of combinations in handling the ring blank may be employed. One of the preferred ways I have tested is to first apply external pressure against the severed or gapped ring blank, preferably in tangential direction to its gap, so as to close its ends, retaining the ends in closed relation by means of a device 24 or similar contrivances, depending upon the form of the severed ends of the blank. When the ends of the ring are thus securely clamped together, I discontinue the formerly applied external pressure upon the ring. By so doing, the blank is retained in a closed ring-like, somewhat oval shape, which it is permitted to freely or naturally assume, while its radial expanding forces in consequence of the freely assumed shape will be in equilibrium at all points of its circumference.

Now a retainer similar to that disclosed in Fig. 3 is employed. The ring held in its freely assumed shape by clamp 24 or similar devices, is placed in the retainer and centered therein by way of a plurality of radially movable blocks indicated at 11. When these blocks have been brought to bear snugly against the closed held ring, without in any way altering its freely assumed shape, and assuring the retention of that freely assumed shape of the ring, the clamping device holding its ends together is released and removed.

This operation may be repeated until a sufficient number of rings has been placed in the receiver so as to abut. An arbor with end plates similar to that indicated at 13 in Fig. 4 is then passed through the receiver and the rings clamped firmly together without disturbing the freely assumed individual shapes of any of the rings held in place by the series of blocks 11.

Thereafter the blocks are loosened and the clamped together rings may be removed from the receiver, centered and their outer circumference reduced to perfect circular shape of the diameter for which they are intended by either turning, grinding, polishing or otherwise machining or treating the rings.

Having reduced their outer circumference to a perfect desired shape the rings may either be re-clamped without releasing them from the arbor, in the manner explained in connection with Figs. 4 and 6, or they may be released from the arbor and filed individually into a cylinder of a corresponding perfect circular shape of the desired diameter, where they are again clamped together but in such a way as to facilitate their inner circumference being shaped by turning, grinding, finishing or otherwise machining or treating to the desired form.

It is obvious that the operations of reducing the ring body to a core may be reversed by first individually closing the gapped ring blank in the manner already described, filing it in its closed form in a receiver like that shown in Fig. 3, adjusting the blocks 11 to the periphery of the freely assumed ring-like shapes, thus maintaining these originally assumed ring shapes, releasing the devices clamping or holding the ring ends together, and clamping the ring shapes within the receiver so as to facilitate their inner circumference being easily machined to desired form.

Then a cylinder or arbor of a diameter corresponding to or being less than the inner diameter of the rings may be inserted and the rings clamped together and centered without disturbing their outer freely assumed circumferential shape and, thus clamped, removed from the receiver. Now their outer circumference is reduced to perfect circular shape of the desired dimension, whereafter the rings are released.

In practice I have found that the deviations of ring blanks prepared for one desired size is so small or may be made as small so that it becomes practicable to eliminate individually adjustable blocks 11 (Fig. 3) in a receiver, and substitute therefor longitudinal ribs, shaped and so arranged as to conform with the average individually freely assumed shape of the rings.

When filing the closed rings in such a receiver and when the rings do not exactly fit therein, a slight twist of the ring brings it in full contact with the ribs or blocks sufficient to retain it in the freely assumed shape when clamp 24 or a similar device holding the rings in closed position is released.

When blanks, prior to their being closed, are roughly finished, receivers may be used of a desired inner shape, for instance, cylinders with an oval inner opening corresponding to the average form freely assumed by roughly finished ring blanks when closed and temporarily clamped in the manner explained herein.

In the drawings are disclosed two typical ring blank shapes having so-called lapjoint cuts. It is self-understood however, that my process may be employed in the manufacture of rings for any purpose and of any desired shape, form, or cross-sections and having various kinds of severed or split joints, such, for instance, as straight, diagonal, interlocking, spiral or other known splits or cuts.

Having thus described my invention, I claim:

1. The process of equalizing all the forces in a closed, gapped piston ring blank, having overlapping ends, which comprises holding said blank together at one point of its overlapping ends.

2. The process of producing piston rings equally expanding at all points of their circumference, which comprises, severing a ring blank, providing its ends with portions designed to over-lap, closing the ring and holding its overlapping ends together at a single point, thus permitting the ring to substantially freely assume a ring-like shape, clamping the rings for the purpose of machining it without altering its assumed shape.

3. The process of producing piston rings equally expanding at all points of their circumference, which comprises, severing a ring blank, providing its ends with portions designed to overlap, closing the ring and holding its overlapping ends together at a single point, thus permitting the ring to substantially freely assume a ring-like shape, clamping the ring circumferentially without altering its assumed shape, releasing its ends, and machining it while thus clamped.

4. The process of producing piston rings equally expanding at all points of their circumference, which comprises closing and fixedly holding a severed ring blank having overlapping ends, at one point of its severed ends, thus permitting it to freely assume a natural ring-like shape in which the expanding forces are equalized, clamping the ring circumferentially without altering its ring-like shape, releasing its overlapping, fixedly held ends, and machining it while the ring is thus clamped.

5. The process of producing piston rings equally expanding at all points of their circumference, which comprises closing and chucking for the purpose of machining a severed ring blank in such a way as to correspond in shape to a severed ring blank which is fixedly held together at one point of its severed ends.

6. The process of producing piston rings equally expanding at all points of their circumference, which comprises closing and fixedly holding for the purpose of machining, a severed ring blank having overlapping ends, in such a way as to correspond in shape to a severed ring blank which is held at one point of its severed ends and which is thus permitted to freely assume a natural, ring-like form in which the expanding forces are equalized.

7. The process of making piston rings, which comprises closing and subsequently chucking for the purpose of machining a plurality of severed piston ring blanks having overlapping ends, in such a manner as to correspond in shape to a plurality of individual severed ring blanks having overlapping ends and which are held singly together at one point of their ends, whereby the rings would freely assume natural, ring-like shapes in which the expanding forces are equalized.

Signed at New York, in the county of New York, and State of New York, this 17th day of August, A. D. 1920.

HARRY S. FRANK.