

R. B. WASSON.
METAL PACKING RING.
APPLICATION FILED JULY 29, 1910.

1,008,999.

Patented Nov. 14, 1911.
2 SHEETS—SHEET 1.

Fig. 1

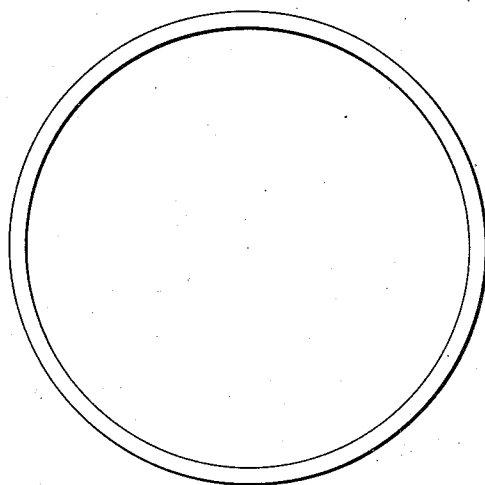


Fig. 3

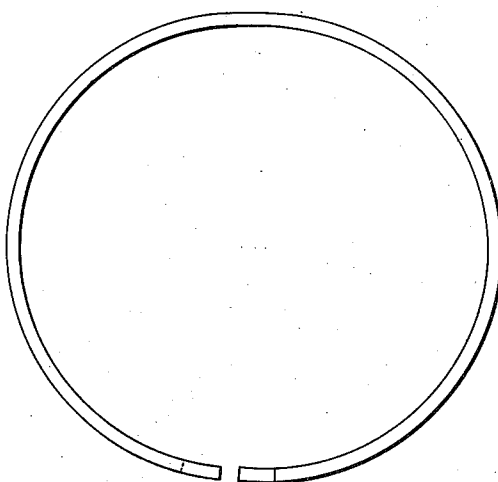


Fig. 2

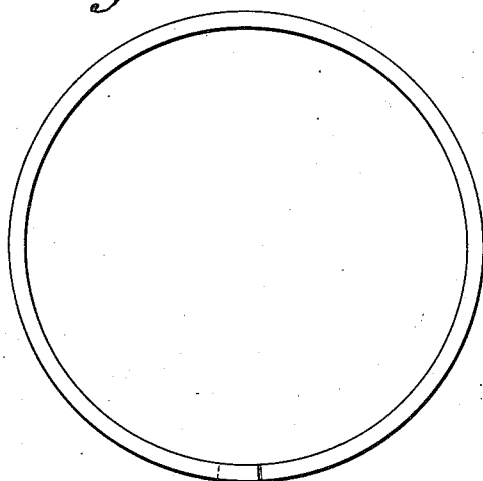


Fig. 4



Fig. 5



Fig. 10

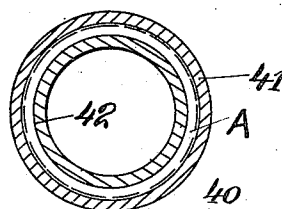
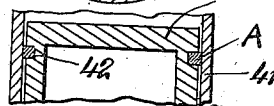


Fig. 11



Witnesses:
J. Kozigaberg
H. B. Sandenberg

Inventor
Robert B. Wasson
By *Wm. J. Bissinger*
Attorney

R. B. WASSON.
METAL PACKING RING.
APPLICATION FILED JULY 29, 1910.

1,008,999.

Patented Nov. 14, 1911.

2 SHEETS—SHEET 2.

Fig. 8

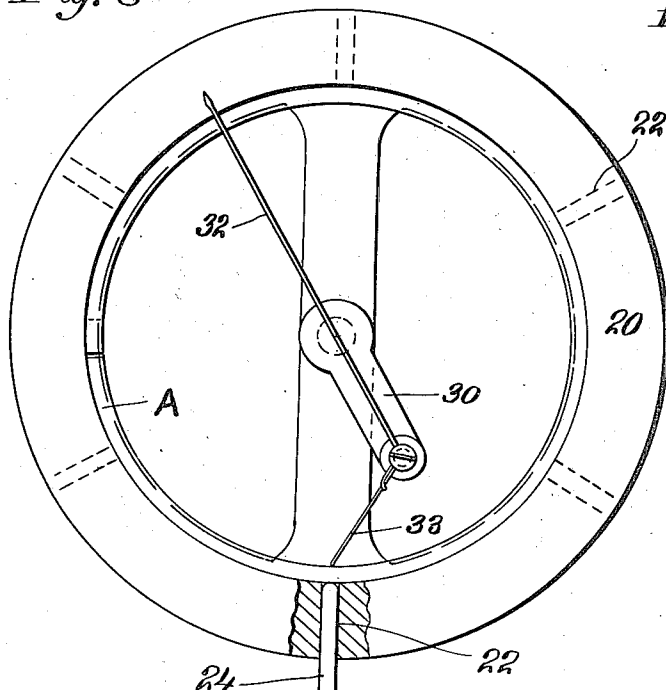


Fig. 9

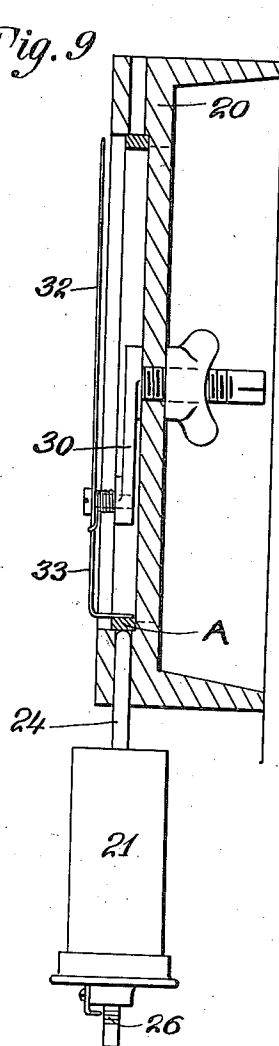


Fig. 6

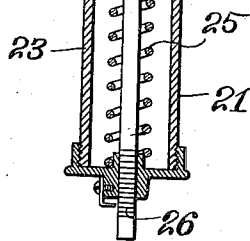
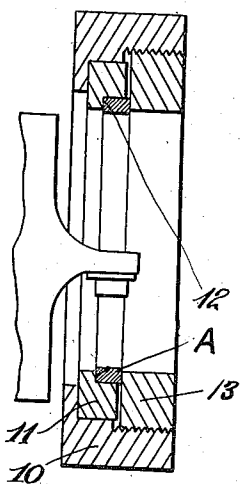
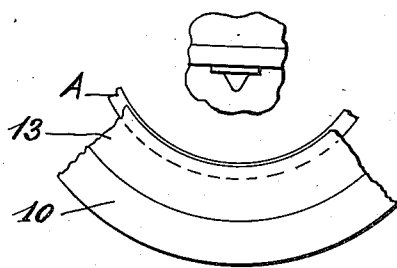


Fig. 7



Witnesses:
D. Kossigberg
A. B. Zanderberg

Inventor
Robert B. Wasson
By *W. J. Bissing* Attorney

UNITED STATES PATENT OFFICE.

ROBERT B. WASSON, OF CRANFORD, NEW JERSEY.

METAL PACKING-RING.

1,008,999.

Specification of Letters Patent.

Patented Nov. 14, 1911.

Application filed July 29, 1910. Serial No. 574,495.

To all whom it may concern:

Be it known that I, ROBERT B. WASSON, a citizen of the United States, residing at Cranford, in the county of Union, State of New Jersey, have invented certain new and useful Improvements in Metal Packing-Rings, of which the following is a specification.

This invention relates to metal packing rings.

The packing rings constructed in accordance with this invention are either in the nature of piston rings, which exert an outward radial pressure, or stuffing box rings, which exert an inward radial pressure. The rings are of that kind in which the radial pressure is due to the resiliency of the metal of the ring, and not to external springs.

Among the objects of the present invention are to provide a packing ring that will form as nearly as possible an absolutely tight joint both with the part carrying it and with the part with which it has slidable contact, to render the radial pressure of the ring uniform at all points circumferentially thereof, to minimize the amount of clearance or space between the ring and the walls of its retaining groove when in working condition, so as to minimize the accumulation of oil, etc., to secure approximately the minimum equal radial pressure that will produce a gas-tight joint, thus reducing wear and friction and consequent loss of power, to secure an equal distribution of weight throughout the annulus so as to avoid the tendency of a plurality of rings under working conditions to localize or align their slots, and to enable the ring to be produced in an economical manner.

With these and other ends in view, the invention may be said to consist in the method and article hereinafter described and more particularly pointed out in the claims.

In the accompanying drawings illustrating the invention: Figure 1 is a plan view of the blank before cutting; Fig. 2 is a similar view of the blank after cutting; Fig. 3 is a plan view of the piston ring after having been hammered so as to cause the ends to separate; Fig. 4 is a side view of Fig. 3; Fig. 5 is a panoramic view of a portion of the inner surface of the piston ring, showing semi-diagrammatically the result of the hammering; Fig. 6 is a sectional view showing the ring held in position to be hammered, and the hammer in position to de-

liver the blow; Fig. 7 is a front view of the lower part of Fig. 6; Fig. 8 is a plan view of the ring and the holder in which it is held while being gaged, and showing also in longitudinal section a suitable instrument for gaging the tension of the ring; Fig. 9 is a sectional side elevation of the parts shown in Fig. 8; and Figs. 10 and 11 are sectional views showing the completed piston ring seated in a groove in a piston and exerting circumferentially-uniform radial spring pressure on the confining wall of the cylinder.

In making a piston ring in accordance with my invention, I may, and preferably do, first produce an annulus of cast iron or other suitable metal which is of the same cross-section throughout, and which is circular both inside and out. Furthermore, this blank may be, and preferably is, of substantially the same external diameter as the bore of the cylinder and of substantially the same internal diameter as the bottom of the groove in the piston in which it is to be seated. The order of the subsequent steps may be varied. In the particular form of the invention here described, I now cut or split the annulus, preferably at one point and preferably with a diagonal cut. The annulus is preferably so cut that a minimum amount of metal is removed, that is, only so much is removed as is necessary to allow for thermal expansion and contraction while in use, say twenty thousandths of an inch. I now proceed to a most important step, which consists in mechanically and permanently distorting the structure of the inside surface portion of the metal ring. This operation results in spreading the annulus, so as to separate its ends, so that, in order to introduce the ring in position on the piston inside the cylinder, it will be necessary to compress the ring back to its normal or original circular form; the ring will then exert a radial outward pressure that is due to the permanent distortion of the structure of the metal at the inner side of the ring. In other words, the permanent internal distortion of the structure of the superficial portion of the metal produces an external distortion of the annulus as a whole in the nature of an expansion or opening; so that the compression of the ring in the cylinder takes away this external distortion of form and acts in opposition to the permanent internal distortion, thereby occasioning the outward spring

pressure. The distortion of the inner superficial region of the ring is preferably accomplished by hammering in the cold, and is preferably in the nature of a superficial compacting or compression of the structure of the metal along the inner circumference so as to produce a kind of compression spring action by the circumferential compacting of the particles of metal. If the material of the ring did not possess elasticity at the outset, the hammering operation gives it elasticity. The operation is so conducted that the degree of distortion is varied circumferentially in a predetermined manner. Thus, the distortion is greatest at the central portion of the ring, opposite the cut, and thence diminishes in both directions to the two ends, where it is minimum. The energy of the blows used in hammering does not decrease uniformly from the middle or uncut to the cut portion of the ring. It decreases at first slowly and then very rapidly and then again more slowly. The superficial distortion is symmetrical or substantially so for both halves of the ring. By means of this graduated distortion of the inner superficial region of the ring I am enabled to secure an equal outward radial pressure at all points circumferentially of the ring. The hammering or distorting operation is so conducted as to leave the radial thickness of the annulus to all intents and purposes unchanged; so that the annulus, as before hammering, is of uniform cross-section throughout. When the ring so made is placed in its groove in a piston and compressed by the confining wall of the cylinder, it fills its groove all the way to the bottom, uniformly all the way around, and preferably it is of the same internal and external diameter as before hammering, and has the same very slightly space between its ends. This space is just sufficient to allow for the differential thermal expansion of the ring and piston, and is substantially closed when the parts heat up to the usual running temperature.

Before the ring is put into use I prefer to grind it on the outer periphery and on the two sides, just sufficiently to insure a smooth joint. The grinding may be done before the ring is cut or split.

In making a stuffing box ring, I start with a blank which may be of cast iron such as I have already described. I now cut as before, removing a minimum amount of metal. The hammering is then performed on the outside of the ring, instead of the inside, the operation being otherwise the same. This hammering operation tends to make the ring contract with its ends overlapped, so that when the ring is seated in its groove in a stuffing box or the like it exerts a uniform radial pressure inward on the shaft. In making a stuffing box ring, I may remove a

very little more metal in the cutting operation than I prefer to do when making a piston ring, or else I may make the blank of slightly smaller diameter internally than the shaft or rod with which the ring is to make a tight, sliding joint; so as to insure that the abutting of the ends of the ring due to thermal expansion of the metal will not put an end to the inward pressure on the shaft. The grinding of the stuffing box ring to produce a smooth joint is performed on the inner surface and the two sides.

I prefer to perform the hammering operation with a hammer or striker having a narrow striking face as long as or longer than the width of the inner or outer face of the annulus. Preferably, the side faces of the striker converge, and the striking face is slightly curved transversely. One form of such a striker is shown in Figs. 6 and 7.

In operation the striking face of the hammer is disposed parallel to the width of the inner or outer surface of the annulus being worked on. I may so distribute the blows of this hammer that they overlap, producing a substantially continuous compacting along the length of the surface of the annulus; but I prefer to space the blows slightly, so that the superficial portion of the annulus will be condensed in a series of parallel strips or lines. This distortion of the structure of the metal may have a visible suggestion in the nature of a slight ribbing or banding of the surface, as shown semi-diagrammatically in Fig. 5. This ribbing as a surface configuration is, however, extremely slight, there being preferably no appreciable distance between the high and low portions of the ribbing. The effect of the distortion produced in this manner, and also where the transverse lines of condensation are caused to overlap, is confined largely or almost entirely to a circumferential direction; that is to say the effect of the blows on the metal may be said to comprise a radial component and a lateral component, and by my method I confine the lateral component to a circular or circumferential direction. In this way, the compacting of the metal is caused to yield maximum results in the way of radial expansion of the ring when the latter is confined in use. Thus the hammering need never be so heavy as to produce appreciable alteration of the cross-section of the ring.

While the hammering is being performed, I prefer to clamp or hold the two sides of the ring in such a way as not to interfere with the hammering operation and to afford a solid support for the circumference that is not being hammered. A suitable device for piston rings is shown in Fig. 6, wherein 10 is a metal holder, sufficiently heavy for the purpose, having an internal circular seat 11 (which may be replaceable by seats of various sizes if desired) for the periphery of

the ring A, 12 is a fixed side clamping face on the seat 11 and 13 is a removable retaining ring, desirably threaded into the holder 10, and affording a complementary side clamping face. Thus, the outer and major portions of the two sides of the piston ring are clamped and the periphery is afforded solid support during the hammering. The side clamping of the ring contributes to the minimizing of the sidewise spreading of the metal under hammering.

From time to time I may, and preferably do, gage the result of the hammering, and proceed with the hammering or cease hammering accordingly. This testing may be effected in a variety of ways. For purposes of illustration I have shown in Figs. 8 and 9, a holder 20 for a piston ring, having an internal circular seat of the same diameter as the cylinder bore which the ring A is to fit. The ring is slipped into this holder from time to time, and a pressure-indicating instrument such as indicated by the numeral 21 is pressed against the periphery of the portion or portions of the ring to be tested. The holder 20 may be provided with any suitable number of radial openings 22, through which the instrument 21 may be inserted against the periphery of the piston ring. The pressure-indicating instrument may be of any suitable nature. The device shown is of known construction, consisting of a barrel 23 through which slides a plunger 24 and in which is contained a spring 25 that opposes the rearward movement of the plunger. The plunger may bear pound graduations 26, to indicate the pressure at which the portion of the ring pressed upon yields from its seat in the holder 20. This is, of course, the same as the outward radial pressure exerted by this portion of the piston ring. In order that the operator may know when the piston ring first begins to yield, any suitable form of multiplying index or other indicator may be employed. For purposes of illustration, I have shown a bracket 30 rotatably mounted on the holder 20, normally locked by a nut 31 and carrying a pivoted pointer 32 the short arm 33 of which in any position of the bracket 30 bears against the inner surface of the piston ring. The ring is tested from time to time during hammering, until an equal pressure is indicated at all points. The hammering is continued only until the minimum radial ring pressure, say five pounds, that will preserve a gas-tight joint, is produced. By means of this gaging step I may perform the hammering of the packing ring entirely by hand and in an empirical manner. Or I may perform the hammering by a suitable machine automatically varying the blows by cam means designated according to the particular size of ring and the particular metal employed. But even if the hammering be

conducted in this manner, the gaging step is useful since it enables variation in the metal of the same ring or different rings to be detected and compensated for by harder or softer hammering as the case may be. In fact one of the features of my invention is that I am enabled to insure uniform radial ring pressure by compensating for all variations in the metal of the ring.

A packing ring made according to my invention is of equal cross-section throughout. The feature of uniform cross-section is of primary importance, since it insures that the ring will not only form a tight joint with the cylinder wall (in case of a piston ring), but also with the piston that carries it, since the groove in the piston is accurately fitted and filled all the way around.

Minimum clearance or space between the ring and the bottom of its groove, produces a gas tight joint. The same is true, of course, with a stuffing box ring, the carrier there being the inclosing part. Packing rings made according to my invention have their weight equally distributed, so that there is no tendency of two or more rings in a piston or stuffing box to work to a position with their slots or cuts in series. The ring in use affords a uniform wearing surface. One of the great features of the ring is that it exerts equal radial pressure at all points circumferentially. Moreover, by my method this pressure may be the minimum that will maintain a gas-tight joint. I thus reduce wear and power loss, which are increased if the pressure is unnecessarily high at any or all points.

In Figs. 10 and 11 I have shown a piston ring A mounted in a customary peripheral groove 42 in a piston 40 and exerting uniform outward radial pressure against the wall of the confining cylinder 41.

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

1. A metal packing ring consisting of a split annulus of uniform cross-section, the metal of which is distorted along one of its curved sides in varying degree so as to cause the ring to exert uniform radial spring pressure.

2. A metal packing ring consisting of a split annulus of uniform cross-section having the metal at one of its curved sides compacted in varying degree ranging from maximum at the region opposite the split toward minimum in both directions therefrom.

3. A metal packing ring consisting of a split annulus of uniform cross-section having at one of its curved sides a permanent distortion of the metal in the nature of a circumferentially-directed compacting which is greatest at the region opposite the split and decreases in both directions.

4. A metal packing ring of uniform cross-section which exerts a circumferentially-uniform radial spring pressure under working conditions by virtue of a circumferentially-varied distortion of the structure of the metal at one of its curved sides.

5. A metal packing ring consisting of a split annulus of uniform cross-section having a permanent mechanical distortion on its inner side, said distortion being in the nature of a compacting of the metal varying circumferentially and causing the ring to exert a circumferentially-uniform outward radial spring pressure under working conditions.

6. A metal packing ring of uniform cross-section and uniformly distributed mass having at one of its curved sides a permanent circumferentially-directed and circumferentially-varied densification of the metal giving rise under working conditions to a circumferentially-uniform radial spring pressure.

7. A metal packing ring of uniform cross-section having at its inner side a permanent circumferentially-directed and circumferentially-varied densification of the metal giving rise when the ring is circularly confined to a circumferentially-uniform outward radial spring pressure.

8. A cast iron packing ring consisting of a split annulus of uniform cross-section having a permanent mechanical distortion on its inner side varying in both directions from maximum at the point opposite the split to minimum toward the split.

9. A metal packing ring having a permanent circumferentially-varied distortion of a structure of the metal at one of its curved sides and adapted by virtue thereof to exert under working conditions a radial spring pressure that is equal at all points circumferentially of the ring.

10. A metal packing ring having a permanent circumferentially-directed and circumferentially-varied densification of the metal at one of its curved sides and adapted by virtue thereof to exert under working conditions a radial spring pressure that is

equal at all points circumferentially of the ring.

11. A metal packing ring which exerts a circumferentially-uniform radial spring pressure under working conditions due to permanent densification of the metal at one of its curved sides, such densification being produced in transverse lines or strips.

12. A metal packing ring of uniform cross-section having transverse-strip-like densification areas of intensity varying from maximum at a central point toward minimum in both directions therefrom distributed along one of its curved sides.

13. A metal packing ring, consisting of a split annulus of uniform cross-section having one of its curved surface regions mechanically and permanently distorted in the nature of a superficial circumferentially-directed compacting of the metal varying in degree from maximum at the point opposite the split to minimum at the ends.

14. The combination with a piston of a metal piston ring therein consisting of a split annulus of uniform cross-section having the structure of the metal along its inner circumference densified in a circumferential direction and in varying degree and adapted to exert an outward radial pressure equal at all points against the confining cylinder wall.

15. The combination of a metal packing ring and a cylindrical surface with which said ring has relative sliding contact, said ring consisting of a split annulus of uniform cross-section having the structure of the metal at one of its curved sides densified in a circumferential direction and in varying degree and exerting a radial pressure against said cylindrical surface equal at all points circumferentially.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

ROBERT B. WASSON.

Witnesses:

W. F. BISSING,

L. F. LITTLE.