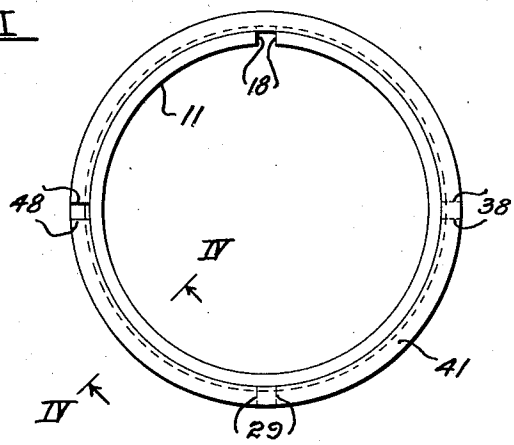
March 10, 1925. 1,529,052

A. E. ANDERSEN

PISTON PACKING RING

Filed Nov. 26, 1923

Fig. I



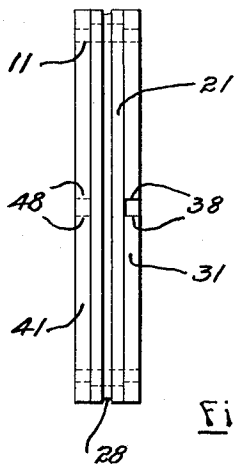
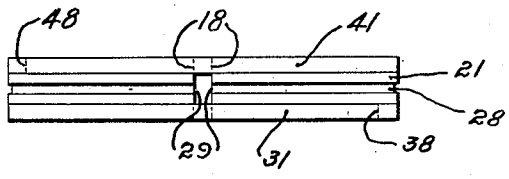


Fig. III

Fig. II



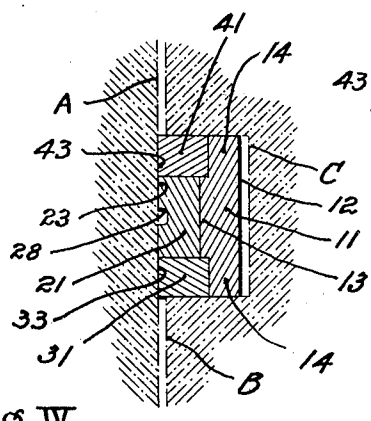


Fig. IV

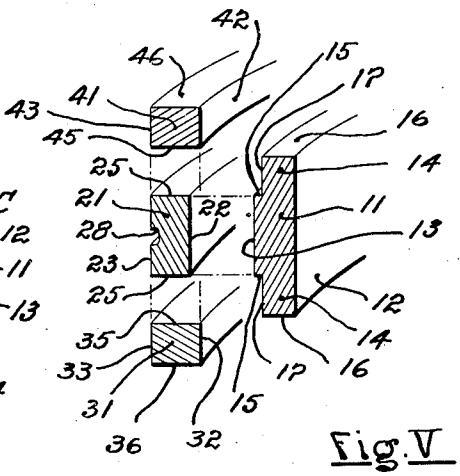


Fig. V

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By his Attorney

H C Karlson

Patented Mar. 10, 1925. 1,529,052

UNITED STATES PATENT OFFICE.

ALFRED EMIL ANDERSEN, OF BROOKLYN, NEW YORK.

PISTON PACKING RING.

Application filed November 26, 1923. Serial No. 677,004.

To all whom it may concern:

Be it known that I, ALFRED EMIL ANDERSEN, a resident of the borough of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Piston Packing Rings, of which the following is a specification.

This invention relates to packing-rings for pistons and cylinders, and it appertains more especially to the species thereof which are composed of plural annuli.

The main object of the invention is to produce an improved packing of the character described, which shall be made up of several exteriorly arranged annuli, simultaneously urged by an interiorly disposed ring against the cylindrical surface wherewith they are to coact, but still having and retaining the capability to yield relatively to the said surface and independently of one another.

A further object is the production of a packing of the nature set forth, wherein the external annuli are of quadrilateral transverse section, and offset in their inner faces in such manner as to break joints one with the other and fill a similar office relatively to interfitting portions of the outer side of the internal ring, while the latter exerts its power of impulsion.

Another object is to provide a packing of the species mentioned, the outer constituent member whereof shall be straight-sided throughout, with all its parts devoid of internal recesses, and sufficiently flexible to conform to the inequalities of surface usually encountered in the walls of cylinders having uneven bores, thereby making a leak-proof packing for the same.

An additional object is the provision of a self-expanding and self-adjusting annular packing of the type specified, the component elements of which can ordinarily be made accurate enough to insure its adaptation to the work assigned, without requiring extremely fine machining and fitting of the several parts, or making the same unduly frail or fragile, and at a cost sufficiently moderate and inviting to users to warrant its general adoption.

Other objects and advantages of the invention will become apparent as the specification proceeds.

With the aforesaid objects in view, the invention consists of the novel combinations and arrangements of parts hereinafter described in their preferred embodiments, pointed out in the subjoined claims, and illustrated on the annexed drawing, wherein like parts are designated by the same reference characters throughout the several views.

Certain types of four-piece piston packing rings hitherto in use have been open to the following objections, viz: Their external annuli, which contacted with the internal walls of the cylinder, were not freely yielding individually, because the narrower ones, usually placed at opposite ends, could not expand and contract of themselves, but were controlled by the wider middle annulus. The construction, moreover, was such as to require most careful workmanship and interfitting to make these piston rings even approximately leak-proof. Skilful machinists only could produce the same, and this naturally served to augment the costs of manufacture. Furthermore, the end annuli, before referred to, had to be made rather delicate, in order to possess sufficient resiliency, and for that reason became fragile, and often fractured, not only when manipulated by mechanics of ordinary acumen, but they frequently broke while being manufactured. Another serious defect, inherent in the rings mentioned, was that, due to existing crevices and pockets, any oil finding lodgment therein would carbonize under the action of excessive heat, such as occurs in internal combustion engines, and form an incrustation that rendered them practically inoperative.

Generally described, the improved piston packing-ring under consideration includes in its organization four separate split-annuli, of individually uniform thickness throughout, and grouped together in such a manner that three of them have their external faces fully and entirely in contact with the internal walls of the cylinder into which the piston in inserted. These may be called bearing annuli, and they are urged outwardly against the cylinder's inner walls by an expansion annulus, equal in width to the three contacting annuli, and held closely in juxtaposition interiorly with relation to the same. The central part of this annulus is wider and thicker than its marginal portions, and constitutes an abutment protruding outwardly from the latter, which is placed in direct apposition to the middle one of the series of bearing annuli. The

opposite inner face of the middle external annulus here referred to is of equal width with the adjacent outer side of the expansion annulus, while the end annuli of the exterior series correspond in breadth to the above mentioned marginal portions of the expansion annulus. The end annuli are made narrower peripherally, but of greater depth from the circumference inward, than the central bearing annulus, so that they can reach the said marginal portions and be seated upon the same. All four annuli are of quadrilateral cross-section, with right-angular corners interfitting so as to break joints throughout the packing. At the same time, both the interiorly located annulus and the series of external annuli encompassing it preserve their respective properties of dilatation and resiliency, which enable each and all of them to move, either inwardly or outwardly, irrespective of one another. Consequently, when a rough surface is encountered or unequal wear takes place in a cylinder having a piston equipped with this improved annulose packing, the constituent parts of the latter readily and individually accommodate themselves to these unfavorable conditions without interrelative restraint.

The advantages of the invention as here outlined are best realized when all of its features and instrumentalities are combined in the one and same structure, but, useful devices may be produced embodying less than the whole.

It will be obvious to those skilled in the art to which the invention appertains, upon becoming conversant with the details thereof, that the same may be incorporated in several different constructions. The accompanying drawing, therefore, is submitted merely as showing the preferred exemplification of the invention.

In the said drawing:—

Figure I is a top plan view of the preferred form of packing-ring in which the present invention is embodied, the several parts thereof being shown assembled, but detached from the piston;

Fig. II is a side view of the same construction, that is, looking upwardly from the lower edge of Fig. I;

Fig. III is a view similar to the preceding, showing the ring as it appears from the right-hand side of Fig. I;

Fig. IV shows an enlarged transverse section of the ring, taken from the line IV—IV of Fig. I, looking in the direction of the arrows thereto appertaining, certain adjacent elements of a piston and cylinder, such as this annular packing is provided for, being indicated by dot-and-dash lines; and

Fig. V is a sectional and fragmentary perspective view, on the same scale as Fig. IV, illustrating the improved annular packing diagrammatically, with the component parts thereof in disassociated relation.

Referring now to these several views for a detailed description of the invention thereby exemplified in its preferred embodiment, it will be observed that the known parts of the cylinder and piston wherewith the said annular packing is associated and coacts have been designated by letters of reference, instead of numerals as used for denoting the present improvement. This was done, it will be understood merely to intimate that the said parts are not treated or considered as pertaining exclusively to the latter, but are claimed herein only in so far as they form therewith legitimate combinations of elements capable of yielding novel and useful results.

Of the said reference letters, A identifies a portion of an enclosing wall of a cylinder, in which is fitted a reciprocating piston B. As previously noted, these parts are represented by dot-and-dash lines in Fig. IV. The piston, as the latter-named figure indicates, is formed with grooves in its sides, as at C, the same being made to extend circumferentially therearound and designed to receive the annulate packing herein described. In the example given, the groove C is of the exact dimensions required to accommodate the packing, which ordinarily will be lodged therein in compacted condition. But, owing to inherent resiliency thereto imparted for the purpose, the packing tends constantly to expand in all directions outwards and fill up every interstice between the contiguous surfaces of the piston and cylinder, as shown in Fig. IV, though occasionally it recedes into the groove, when and wherever these surfaces are or become closer to each other.

Structurally, the packing is composed of four distinct, but interrelatively movable, and coacting elements, preferably consisting of split annuli, respectively designated herein by the reference numerals 11, 21, 31, and 41. When assembled, these elements make up together a unitary structure, in the form of a complete ring or annulus, the exterior face of which appears at the outer margin of the grove C, around the periphery of the piston B. When thus positioned the complete annulus is adapted to slide upon and press against the bore of the cylinder A, for which it constitutes a ring-packing, as well as for the piston reciprocable therein.

The innermost split-annulus is made resilient and heavy enough to exert a steady and powerful pressure upon the other split-annuli 21, 31 and 41, which are disposed circularly around it, as plainly shown by the three first figures of the drawing hereto annexed. The surrounding annuli thus encompass the inner split-annulus and are thereby impelled into engagement with the

enclosing cylinder walls. As clearly seen in Fig. IV, the split-annulus 11 extends across the groove C for the full width thereof, and is slightly spaced from its bottom, as indicated at 12.

The outer side of the split annulus 11 is of stepped formation, as represented in Figs. IV and V. That is, the central part 13 of the split-annulus has a greater thickness than either margin thereof, this middle portion of the annulus extending belt-like longitudinally therearound. The thinner margins, following the belt in an axial direction, form shoulder portions 14, respectively resting edgewise against the opposite walls of the piston's groove C. Lateral offsets 15, likewise axially disposed, are provided intermediate the outer faces of the central raised part 13 and of its adjoining marginal portions 14. Both of these offsets are in parallelism with the transverse faces 16 of the longitudinal edges of the split-annulus 11, and like them extend at right angles to the outer faces 17 of the shoulder portions, as well as to the exteriorly facing side of the middle part 13, and the inwardly turned face 12 of this split-annulus. The outer face of the part 13 is preferably made as wide as the two faces 17 taken together, and terminates therewith at a gap 18, produced by cutting out and removing a small portion of the annulus, as appears between its adjacent extremities in Fig. I of the drawing.

Both the outer and inner faces, 22 and 23 respectively, of the central annulus 21, pertaining to the exterior series of split-annuli, are of same width as the thick middle portion 13 of the split-annulus 11, hereinabove described. In other words, the transverse sides 25 of the split-annulus 21 are spaced as far apart as the offsets 15, previously referred to, and consequently are parallel therewith. The outer face 23, which comes into sliding engagement with the inner face of the cylinder A, has a retaining groove 28, adapted to contain oil or other suitable lubricant. This groove is formed substantially midway between the sides 25 of the split-annulus, and extends throughout the length thereof peripherally. A gap intervening between the parted ends of the split-annulus 21 is represented at 29, in Figs. I and II, in line with the middle of the gap 18 of the split-annulus 11, and at a point diametrically opposite.

The split-annuli 31 and 41, located at the ends of the external series, are disposed with their counter-facing transverse sides 35 and 45 respectively touching the adjacent sides 25 of the central split-annulus 21. These end bearing or sealing annuli are made of sufficient depth, measured from the outer periphery inwards, to reach the outwardly presented faces 17 of the before mentioned marginal or shoulder portions 14 of the interiorly situated split-annulus 11. The split-annuli 31 and 41 thus become seated upon the margins 14, where their inner faces 32 and 42 meet the said faces 17. It will therefore be seen that the breadth of the transverse sides 35 and 45 equals the combined widths of the contiguous sides 25 and offsets 15, that respectively appertain to the central split-annulus 21 and the belt-like part 13 of the interior split-annulus 11 behind it. The exterior faces 33 and 43 of the split-annuli 31 and 41 respectively correspond in breadth to the inside faces 32 and 42, and also are of same width as the faces 17 of the marginal portions 14, so that the outer transverse faces 36 and 46 of these split-annuli lie flush with the transverse ends 16 of the marginal portions 14, when the various elements composing the annular packing are assembled to make up the operative unit lodged in the groove C of the piston B. The gaps separating the terminals of the split-annuli 31 and 41 are denoted by 38 and 48, respectively. See Figures I and III.

A sufficient power of expansion is stored in the internal split-annulus 11 to overcome the relatively inferior compression stress of the external series of split-annuli 21, 31, and 41. The available force derived therefrom is transmitted by contact of the outwardly turned faces 13 and 17 of the former with the oppositely positioned inner faces 22, 32, and 42 of the latter. The external series of split-annuli is thus urged by the expansion split-annulus into close engagement with the bore of the cylinder A. In the meantime, by virtue of the straight and continuous line of contact between the inner transverse faces 35, 45 and the juxtaposed faces 25 and 15, the laterally disposed split-annuli 31, 41 are free to yield with respect to both the central split-annulus 21 and the interior split-annulus 11, while still breaking joints with the permanently contacting faces 22 and 13 respectively pertaining to the split-annuli 21 and 11.

By reason of the fact that the bearing on sealing split-annuli 21, 31, and 41 are of quadrilateral transverse section and have a certain freedom of movement independently of one another, they can adjust themselves to such inequalities of surface as may exist or occur in the bore of the cylinder in which the piston reciprocates. Furthermore, since there is no collective restraint on this series of split-annuli, they can either expand or contract separately, and if some foreign matter reaches their interengaging surfaces, it finds no crevices to become lodged in, but is promptly ejected or brushed aside through the interrelative movement of the several split-annuli.

Although no dowels or similar retaining devices have been shown intermediate the

various split-annuli, it is obvious that the like may be employed whenever deemed necessary or desirable. Such devices may be advantageously resorted to, for instance, in connection with the larger sizes of piston packing-rings constructed on the principle of the present invention, for the purpose of holding together the different elements of the complete annulus in their assigned relation.

While a certain preferred embodiment of this packing device has been shown and described, it will be understood that changes in the form, arrangements, proportions, sizes and details thereof may be made, without departing from the scope of the invention as defined by the appended claims.

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

1. A self-adjusting annular packing adapted to surround a reciprocable element fitted in a bored member, including a differentially yieldable split-annulus capable of expanding and contracting automatically within a circumferential groove of said element, said split-annulus comprising a relatively thick central part and thinner marginal portions by the sides thereof, and a series of split-annuli disposed side by side around the split-annulus so as to fill said groove, said split-annuli being of different thicknesses inversely proportional to said central part and said marginal portions and individually urged by them into contact with the interior surface of said member.

2. A self-adjusting annular packing adapted to surround a reciprocable element fitted in a bored member, including a resilient split-annulus placed in a peripheral groove of said element so as to be free to expand and contract therein, and a series of split-annuli separately encircling said split-annulus in a manner to fill said groove, said split-annulus having a raised centre and depressed margins offset therefrom, said split-annuli being of different thicknesses forming an intermediate recess engaged by said centre and lateral protuberances seated upon said margins, and the individual split-annuli in said series having each a compression stress inferior to the power of expansion of the thereto related part pertaining to the split-annulus, the arrangement being such that the several split-annuli in the series are respectively urged by the corresponding parts of the split-annulus against the said member's interior surface.

3. A self-adjusting annular-packing adapted to surround a reciprocable element fitted in a bored member, including an automatically expansible and contractible split-annulus located in a perimetral groove of said element, said groove having parallel side walls perpendicular to the bottom thereof, said split-annulus being formed with an outwardly projecting central part, offsets on each side of the latter and shoulder portions receding toward the bottom of the groove while extending laterally to its said walls, said offsets being parallel to both walls and to each other, and a series of split-annuli respectively laid upon the central part and the shoulder portions of the split-annulus in position to be individually urged thereby into contact with the bore of said member, the middle split-annulus of said series being engaged by said central part intermediate of its said offsets, and the end split-annuli of the series finding seats upon said shoulder portions.

ALFRED EMIL ANDERSEN.