April 4, 1939. J. RAIS 2,153,025

PACKING RING FOR SEALING THE PISTONS AND PISTON RODS

Filed March 23, 1934. 2 Sheets-Sheet 1

Fig. 1.

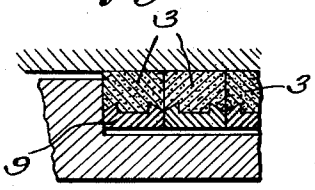


Fig. 11.

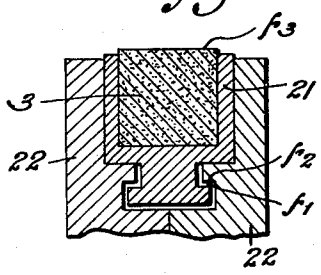


Fig. 2.

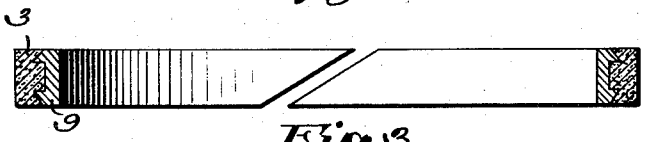


Fig. 3.

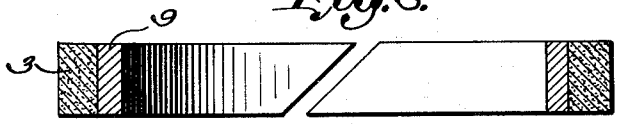


Fig. 12.

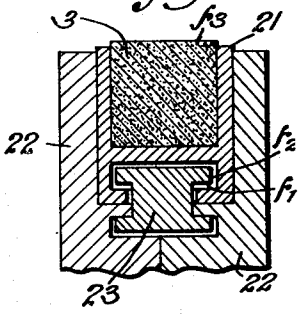


Fig. 4.

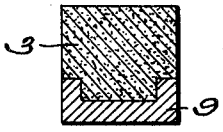


Fig. 5.

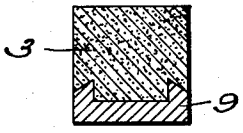


Fig. 6.

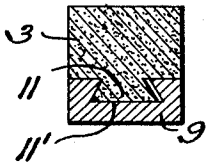


Fig. 7.

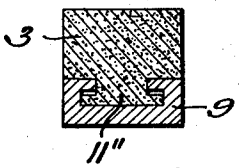


Fig. 13.

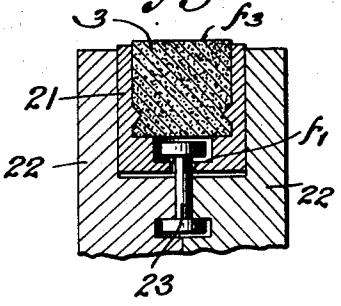


Fig. 8.

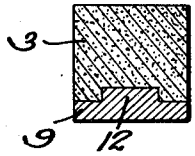


Fig. 9.

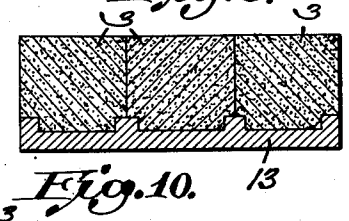
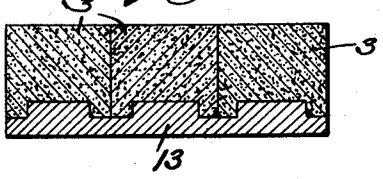


Fig. 10.



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April 4, 1939. J. RAIS 2,153,025

PACKING RING FOR SEALING THE PISTONS AND PISTON RODS

Filed March 23, 1934 2 Sheets-Sheet 2

Fig. 14.

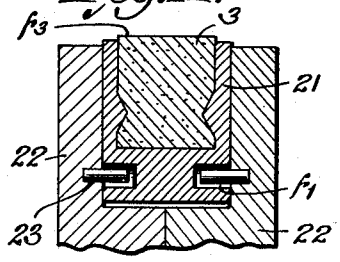


Fig. 15.

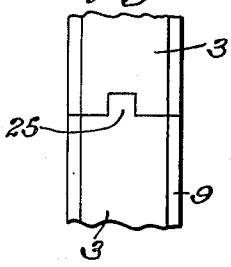


Fig. 16.

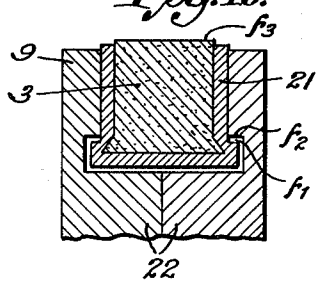


Fig. 17.

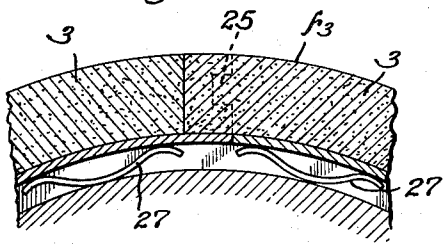


Fig. 20.

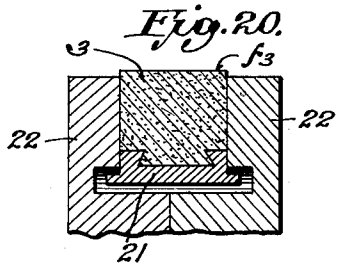


Fig. 18.

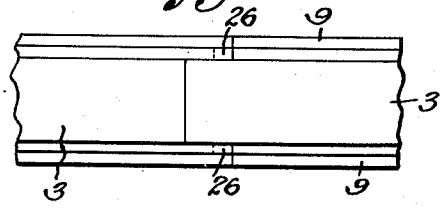


Fig. 21.

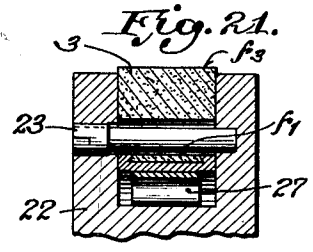


Fig. 19.

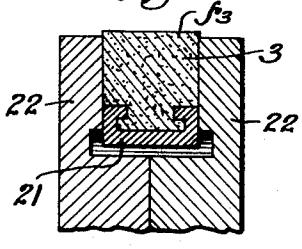
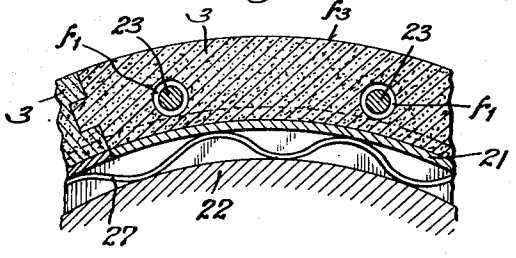


Fig. 22.



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Patented Apr. 4, 1939 2,153,025

UNITED STATES PATENT OFFICE

2,153,025

PACKING RING FOR SEALING THE PISTONS AND PISTON RODS

Josef Rais, Prague, Czechoslovakia, assignor to the firm Limited Company formerly the Skoda Works, Pilsen, Prague, Czechoslovakia

Application March 23, 1934, Serial No. 716,998
In Czechoslovakia April 21, 1933

5 Claims. (Cl. 309—23)

This invention relates to a new and improved type of packing ring for sealing the pistons and piston rods of reciprocating engines and machines using working cylinders and reciprocating pistons. The known constructions of engines and machines of this type suffer from the disadvantage that the packing members must of necessity be lubricated with some special lubricant supplied from without. This requirement results in a considerable increase in the cost of running, and expensive means are necessary for reducing the quantity of lubricating oil to the minimum. In steam engines, the lubricating oil contaminates the exhaust steam, so that the latter cannot be used for certain purposes, since it contains excessively large quantities of oil. In the case of compressors, the lubricating oil can be caused to ignite in consequence of the increased air temperature, thereby resulting in an explosion and hence the destruction of the entire machine. Furthermore, the coolers are apt to become fouled by the lubricating oil, so that a special oil-eliminating device becomes necessary. In the case of compressors in which a lubricant other than oil is employed, the pistons must be provided with soft packing means, for example cups, which are, however, comparatively short lived. In the case of refrigerating machines also, the lubrication with oil, glycerine, and other lubricants often gives rise to troublesome disturbances. Similar inconveniences due to the necessity for lubrication occur in the case of internal combustion engines also.

The present invention overcomes these drawbacks by virtue of the arrangement that the packing members of the pistons or piston rods, or of both, consist of rings of carbon, graphite, or similar frictionless self-lubricating material, which rings are so resiliently mounted relatively to spring metallic supporting or holding means, that the necessary radial resiliency is provided without any independent lubrication whatever.

These carbon rings are inserted in metal holding bushes, both the ring of self-lubricating material and also the resilient metal holding means being cut through by a single cut, for the purpose of enabling the entire packing member to be resilient radially.

The packing ring according to the invention is rendered particularly well able to withstand the strains and stresses to which it is subjected by virtue of the arrangement that the ring consists of two coaxial independent rings loosely mounted one upon the other.

Constructional examples of the invention are shown diagrammatically in the accompanying drawings, in which:

Fig. 1 is a fragmentary sectional view of a piston carrying a series of piston rings according to the invention.

Fig. 2 shows a carbon piston ring in sectional elevation.

Fig. 3 shows a special form of construction of a carbon packing ring.

Figs. 4 to 8 show further modified forms of the carbon packing ring according to the invention.

Figs. 9 and 10 show, in section, packing units made up of a plurality of juxtaposed carbon packing rings.

Figs. 11 to 18 show sections of modified forms of packing rings inlaid in the material of the shell of the piston, Fig. 15 being a plan view of Fig. 14, and Fig. 18 a plan view of Fig. 17.

Figs. 19 to 22 are illustrative of the application of the holding bushing to the under side of the ring, Fig. 22 being a section on a midplane at right angles to that of Fig. 21.

Referring to the figures, Fig. 1 shows a part of a grooved piston carrying a series of piston rings, each comprising a carbon ring 3 inserted in a metallic bush 9.

Fig. 2 shows a carbon piston ring 3 in sectional elevation. From this figure it will be seen that the bush 9 as well as the carbon ring 3 are cut through by a single oblique cut.

In the hitherto known constructions of packing rings of carbon, graphite, or similar material the ring is either divided into a plurality of segments or else is rigidly connected to a metallic base. The first mentioned principle of construction does not ensure a perfect seal nor a uniform pressure of the packing ring against the co-operating surface, whereas with the second principle of construction the independent stressing of the carbon packing ring is prevented, and in addition detrimental stresses are transmitted from the underlying base to the carbon ring whereby either the connection between the carbon ring and the metallic underlying base or else the carbon ring itself is damaged.

These disadvantages are overcome by the present invention, by virtue of the arrangement that the metallic ring is loosely inserted in the carbon ring, with possible locking against lateral displacement. In accordance with the invention, the packing ring may for this purpose consist of two coaxial and independent rings loosely mounted one upon the other. These two rings are mounted one upon the other without any rigid

interconnection whatever, with the result that the resilient action of the metallic ring is uniformly transmitted to the carbon packing ring. The sealing action of a packing ring constructed in accordance with the invention can be increased or reduced as required in the various cases of utilizing the rings in machines by choosing suitable metallic resilient material for the production of the resilient metallic ring. The seating surface between the two rings can be cylindrical, but may with advantage be provided with one or more grooves of any desired configuration for the purpose of preventing axial displacement. Packing rings constructed in this manner permit of radial movement of the ring performing the packing function. In this case, however, if the grooves be of dove-tail or other shape, it is necessary to provide such connection between carbon ring and metallic ring with an amount of play which admits of displacement within limits permitting of perfectly uniform resilience of the packing ring.

The resilient packing ring according to the invention is cut through in a normal manner at one point on its periphery, the cut in the packing ring and that in the metallic ring but either coincident or in offset relation to each other.

In the form shown in Fig. 2 the carbon packing ring **3** is provided with a projection which engages in the correspondingly shaped groove in the metallic ring **9**.

In the form shown in Fig. 3 the carbon packing ring **3** is loosely set on the metallic ring **9**. This figure illustrates a form of construction in which the packing ring **3** is loosely mounted on the outer peripheral surface of the metallic ring **9**.

The metal ring or the carbon ring of a packing ring according to the invention may be provided with a groove of any desired shape in which a projection of corresponding shape on the carbon ring or alternatively on the metallic ring engages.

For providing better axial fixation of the carbon ring **3**, of the type shown in Fig. 4, the outer edges on either side of the metallic ring **9** may be shaped obliquely as shown in Fig. 5.

In the form shown in Fig. 6 the metallic ring **9** is provided with a groove **11'** of dove-tail section in which the carbon ring is loosely mounted by means of its projection **11**, with a certain amount of play.

In the form shown in Fig. 7 the carbon packing ring is provided with a pedestal shaped extension **11''** which fits into a corresponding recess in the metallic ring. In this case also there is a certain amount of play between the metallic ring and the carbon packing ring.

Fig. 8 shows a constructional example in which the metallic ring **9** is provided with a projection **12** which engages in a corresponding recess in the packing ring **3**.

In the form shown in Fig. 9 a number of carbon packing rings **3** are loosely mounted, in accordance with the invention, in a single holding ring **13**.

In the form shown in Fig. 10 there are likewise several rings loosely mounted in a single metallic ring, the projections being in this case provided on the metallic ring.

Experience has shown that the main condition for effective sealing action is the close fitting of the packing rings upon the gliding or running surface, without any clearance which would interfere with the packing efficiency, and without excessively high specific pressures which would lead to excessively rapid wearing of the rings.

The requirements in this direction are fulfilled, in accordance with the invention, by an arrangement in which the carbon ring is pressed against the co-operating gliding surface by means of independent resilient means.

In order to obtain the required close fit of the packing rings against their running surface these rings must be so pressed against this surface resiliently that their peripheral surface contacts at all points with the said running surface, without the occurrence of excessive specific pressures between these respective surfaces. The pressure holding these surfaces together must, however, be sufficiently great to prevent the penetration therebetween of the driving medium which strives to lift the ring from the cylinder surface. The pressing-on force must therefore be considerable, but it must at the same time be so restricted that it does not produce a detrimental effect on the running surface of the packing ring.

In accordance with the invention this result is achieved by the arrangement that the self-lubricating material is placed in a metallic backing or bush provided with surfaces adapted to fix or limit the outward radial movement of the packing ring.

After the running in of the machine or engine, the packing ring bears against this limiting seating surface which thus takes up the force of the pressing-on springs. In this manner an excessive spreading of the ring is avoided.

In Figs. 11 to 22, all of which show packing rings and their mounting in the shell of a piston, the segments of self-lubricating material (carbon, graphite, and the like) are denoted by **3**, the metallic backing or bush by **21**, and the shell of the piston by **22**. The backing or bush either takes the form of a spring liner, or helical or leaf springs **27** are provided beneath the rings.

In accordance with the invention the self-lubricating material of the outer ring is so inserted in the metallic backing or bush that it is prevented from displacement or removal by the shape of the contacting surfaces of the latter.

According to Figs. 11 to 16 and 20 to 22 bearing or limiting surfaces f_1 are formed either on the backing or on the carbon ring, and in any case check the spreading of the ring beyond a certain predetermined extent. When fitting a new ring a suitable amount of play is left between the two surfaces f_1 to permit of the running-in of the packing surface f_3 of the packing ring against the inner surface of the cylinder. The running-in should be effected slowly and carefully, so that no damage is done to the contacting surfaces. As soon as the surface f_1 bears against the corresponding arresting surface on the shell of the piston or on a stop member **23** (see Figs. 12, 13, 14 and 21) the load of the spring pressing-on means is taken off the packing surface, and the ring is in the final run-in state. The running-in of the packing rings can be effected in various ways, on the one hand according to the material of which the ring is made, and on the other hand according to the construction of the engine or machine concerned. The running of the piston in the cylinder must be accurate, without movement in a radial direction.

The surfaces f_1 can be provided either over the entire circumference or merely at certain points thereon.

Figs. 11 to 17 show a packing ring in which the metallic bush **21** encloses the self-lubricating material on three sides, and thus serves to effect the connection between the ring and the piston.

Figs. 19 and 22 show arrangements in which the metallic backing is provided merely on the under side of the ring.

In accordance with the invention the packing ring may be constructed in such a manner that its resiliency in a radial sense is effected by metallic means provided beneath the ring.

Figs. 11 to 20 show constructions in which the piston is divided for the insertion of the rings. Figs. 21 and 22 show an arrangement in which the rings can be inserted in grooves in an undivided piston.

More particularly the last-mentioned form of construction permits of the ready fitting of the rings for fresh running-in after the overhauling of the engine or machine. In this case the stop members 23 are so constructed as to be readily and simply removable. In the forms shown in Figs. 12 to 14 these members can only be inserted when the piston is taken apart. When a plurality of juxtaposed piston rings is employed the holding pins, as indicated in Fig. 21 may be common for all the rings; it is then merely necessary in assembling to insert consecutively the segments of all the rows together. The contacting ends of the ring at the slot may be provided with grooves and tongues 25 (see Fig. 15) for purpose of forming tight joints, and if desired the metallic backing or bush of the ring can be provided with a similar jointing arrangement 26 (Figs. 17 and 18).

The joints in the packing rings of self-lubricating material and in the backings or bushes can be arranged in alternating formation, and the springs 27 for the spreading of the segments can be arranged either in the shell of the piston or associated with the packing ring, and can be in the form either of a single strip spring, or of individual springs, or of an undulating strip, as illustrated in the figures of the drawings.

What is claimed is:

1. A packing ring arrangement for sealing pistons and the like, comprising a slotted one-piece ring of self-lubricating solid carbon, and a slotted steel ring for resiliently supporting and also exerting an outward pressure upon said carbon ring, said carbon ring being loosely mounted upon the peripheral surface of said steel ring, to be free for radial movement with respect to the latter.

2. A packing ring arrangement as set forth in claim 1, in which said steel ring has a groove therein, and said carbon ring is provided with a portion engaging in said groove.

3. In combination with a piston, a packing ring comprising a steel ring and a ring of solid self-lubricating carbon resiliently supported by said steel ring and mounted upon the peripheral surface thereof to be free for radial movement with respect to the latter, and engaging means on said piston and packing ring for limiting the outward movement of the latter with respect to said piston.

4. In combination with a piston a packing ring, comprising a steel ring and a ring of solid self-lubricating carbon resiliently supported by said steel ring and mounted upon the peripheral surface thereof to be free for radial movement with respect to the latter, and engaging means on said piston and packing ring for limiting the outward movement of the latter with respect to said piston, said engaging means comprising stop means arranged symmetrically along the periphery of said piston and having one portion associated with the packing ring and another portion associated with the piston.

5. In combination with a piston a packing ring, comprising a steel ring and a ring of solid self-lubricating carbon resiliently supported by said steel ring and mounted upon the peripheral surface thereof to be free for radial movement with respect to the latter, and engaging means on said piston and packing ring for limiting the outward movement of the latter with respect to said piston, said engaging means comprising transverse apertures in the packing ring symmetrically distributed along its periphery, and stop pins carried by the piston and engaging in said apertures.

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