Aug. 6, 1946. W. KILCHENMANN 2,405,152

PACKING FOR CYLINDRICAL PARTS

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Fig. 1

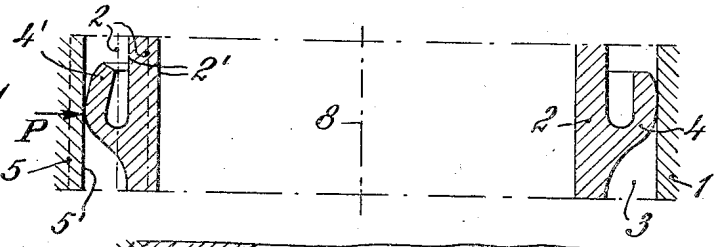

Fig. 2,

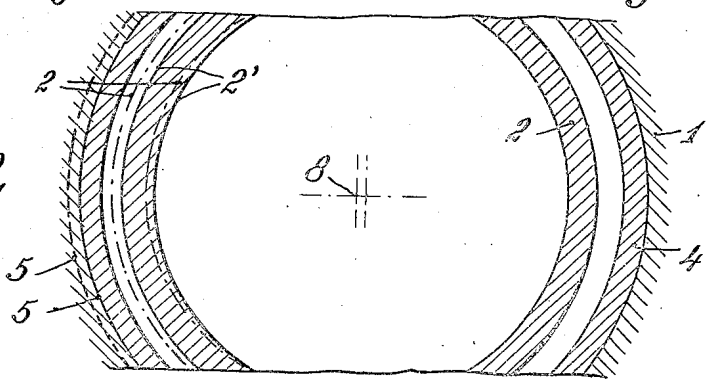

Fig. 4,

Fig. 3,

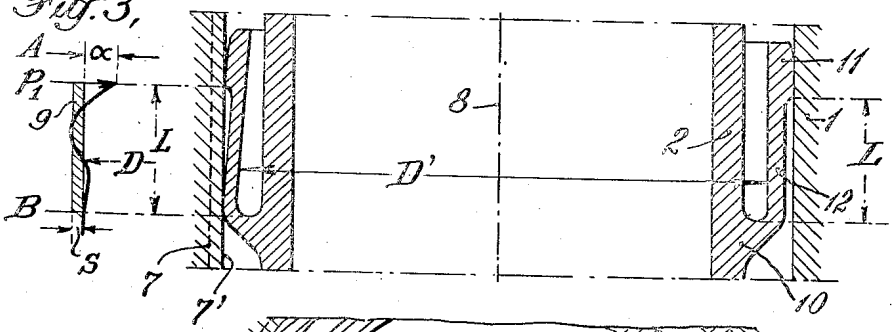

Fig. 5.

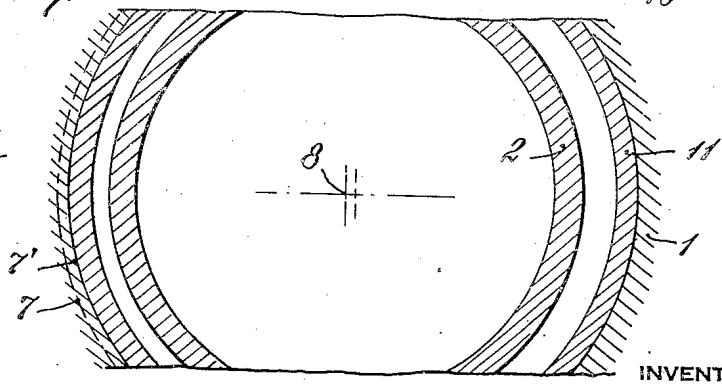

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Fig. 6,

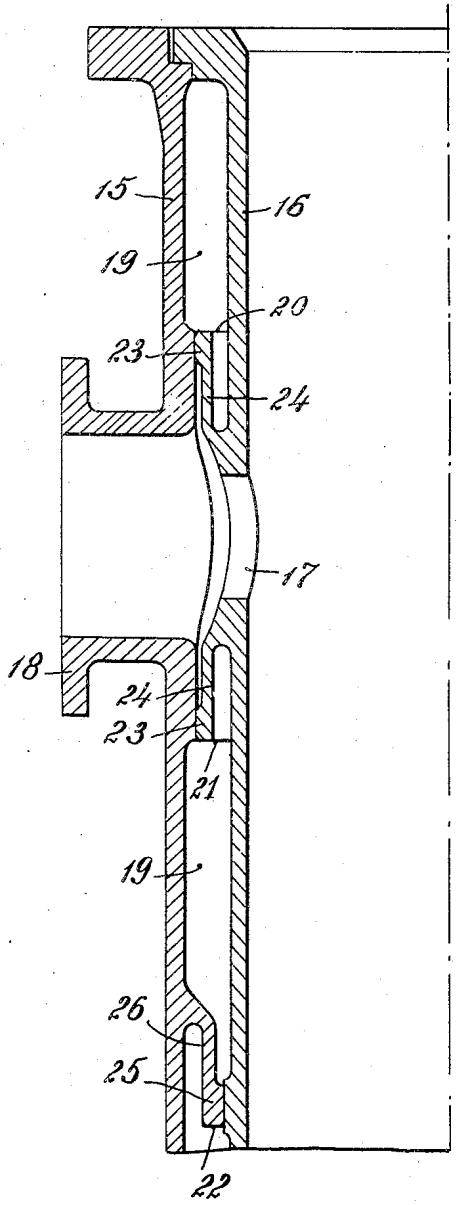

Fig. 7,

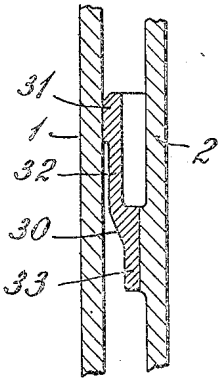

Fig. 9,

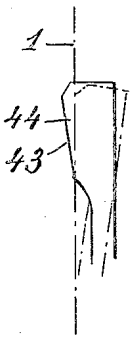

Fig. 8

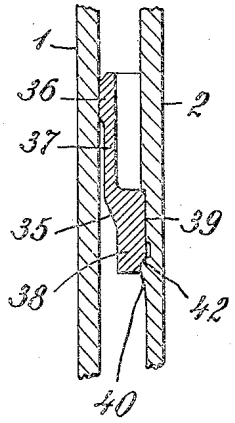

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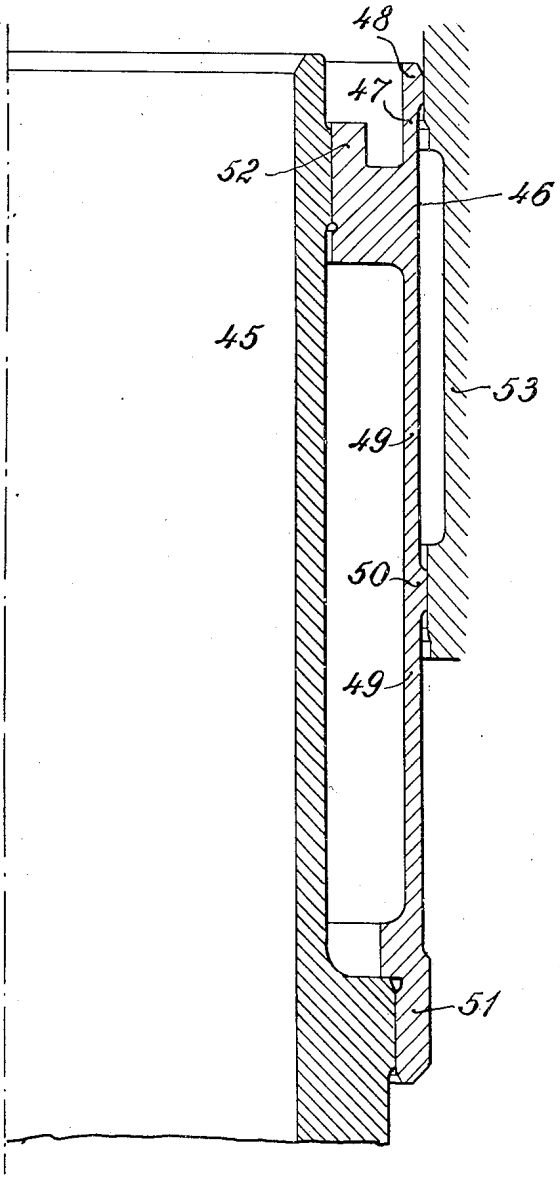
Fig. 10



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Patented Aug. 6, 1946

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UNITED STATES PATENT OFFICE

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PACKING FOR CYLINDRICAL PARTS

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Application May 18, 1944, Serial No. 536,111

8 Claims. (Cl. 123—173)

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The invention relates to a packing between two cylindrical parts which remain for the most part at rest relatively to each other, particularly in the axial direction, and is specially intended for use between the liner and jacket of internal combustion engine cylinders. The purpose of the packing is, when both parts are displaced transversely to the axis or when the circular form of the sealing surface undergoes any change, to eliminate any reaction of the first on the second of the two parts.

It is known in internal combustion engines to use rubber packings between the liner and jacket for sealing the cooling-spaces. These rubber packings are often arranged in grooves in the liner, a play being provided in case of expansion from heat or of displacements between the jacket and liner, and this play being sealed by the rubber so that no metallic contact between the two parts takes place.

In order to eliminate the disadvantages of rubber packings, metallic packings have already been proposed. In the use of known packings of this type between the liner and jacket of internal combustion engines, the metallic sealing part is connected at its root direct to the liner. This has the disadvantage that, when the jacket is deformed under the influence of heating during service, the connection causes a reaction on the liner in that the liner is also deformed at this point and loses its circular form.

The invention obviates this disadvantage by providing the packing not only with a metal sealing ring, which is held against the sealing surface of one part by means of the pressure produced as a result of elastic deformation when the packing is inserted, but also with an apron flexibly connecting the ring to the other part, which apron extends in the main in the direction of the cylinder axis.

In the drawings several exemplifications of the invention are shown and compared with known packings.

Figs. 1 and 2 show longitudinal and cross sections of a known metallic packing.

Fig. 3 illustrates the curve of deformation of a cylinder subjected to pressure at the free end.

Figs. 4 and 5 show the design proposed in the invention in longitudinal and cross section.

Figs. 6–8 are means for fixing the packing on the cylinder of an internal combustion engine.

Fig. 9 illustrates the tapered design of the sealing surface.

Fig. 10 shows the design of a double apron.

The cylindrical part 1 in Fig. 1 lies in its cold

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state concentric with the cylindrical part 2. The space 3 between the two is sealed by the known type of packing 4. If in service the inner wall 5 of the part 1 on the left-hand side of Fig. 1 is displaced inwards relatively to the axis 8, for instance through heating, and arrives in the position 5', a pressure P is exerted on the packing 4, and this has the result that the packing 4 takes on the form 4' at the place in question. Consequently the part 2 is pushed inwards and comes into the position 2', that is to say, its cross-section loses its circular form in the left part. These displacements are shown in the figures on a very exaggerated scale.

If the part 2 represents a cylinder for a reciprocating piston, at the point in question the play for the piston is decreased and the latter may in some circumstances seize up. If the part 2 is a bearing for a shaft, the seizing-up of the shaft may likewise take place.

Fig. 3 shows how a cylinder 9, which is subjected at its free end A to a pressure P_1 acting upon a part or the whole circumference, is crushed out of shape. The deformation α at the end has the result that inside the cylinder jacket bending moments present themselves which cause a bulging of the generating lines of the cylinder towards the inside and outside. This bulging smooths out quickly until it comes back to the original cylindrical form at the point B.

The length L of this zone of influence depends on the diameter D of the cylinder 9 among other things. For cylinders with thin walls the length L might amount to $0.1 \times D$. In Figs. 4 and 5 the packing 10 therefore consists of a ring 11, which presses elastically against the part 1 and provides metallic sealing, and an apron 12 which connects the ring 11 with the part 2 and which extends in the main in the direction of the cylinder axis 8. The length L of the apron must correspond to at least one tenth of its diameter D'. If now the part 1 on the left-hand side of Figs. 4 and 5 is deformed and the inner surface 7 comes into the position 7', the form of the part 2 is nevertheless not impaired. The part 2 not only remains cylindrical but also retains its position relative to the axis 8, so that neither a piston working in the cylinder 2 nor a shaft supported in it is in danger of seizing.

Fig. 6 shows a longitudinal section of the cylinder of an internal combustion engine with a jacket 15 and a liner 16 which is provided with ports 17, these ports being connected to the branch 18 for admission or exhaust. Between the jacket 15 and the liner 16 a cooling-space 19 is

provided, which is sealed by the packings 20, 21 and 22. The packings 20 and 21 with the packing rings 23 and the aprons 24 are attached to the liner 16 and press against the jacket 15. On the other hand, the packing ring 25 of the packing 22 is fixed to the jacket 15 by means of the apron 26 and lies with a metallic sealing effect against the liner 16.

In Fig. 7 the packing 30 with the ring 31 and the apron 32 is shrunk on to the part 2 by means of the flange 33, in order to make it possible to replace the packing 30 without renewing the part 2. In Fig. 6 the liner 16 would have to be replaced if the packings 20 and 21 should be fractured, while the jacket 15 would have to be renewed if the packing 22 should be broken.

Instead of the shrinking-on of the packing, Fig. 8 shows a packing 35 with a ring 36, an apron 37 and a flange 38, which last is pushed over the tapered surface 40 into the groove 39 in the cylindrical part 2. When the packing 35 is pushed upwards on the cylinder 2, the surface 40 elastically deforms the flange 38. The packing 35 is then secured against displacement by the stop 42.

In Fig. 9 the sealing surface 43 of the packing ring 44 is of a tapered design which is such that, when the packing is inserted, the ring 44 lies against the part 1 along its whole height.

Instead of being arranged between two machine parts, such a packing may also be arranged between the walls of two vessels. In Fig. 10 the inner cylinder 45 of any vessel is surrounded by the part 46, which has an apron 47 with the packing ring 48 and also a double apron 49 with the packing ring 50. The double apron 49 is shrunk on to the inner cylinder 45 both at its end 51 and at its end 52. The packing rings 48 and 50 then press elastically against the outer jacket 53 and provide metallic sealing.

I claim:

1. In a packing for use in an annular space between inner and outer cylindrical parts, the improvement which comprises a ring on the packing having a surface which bears against one of the cylindrical parts in the annular space and an annular apron integral with the ring, means connecting said apron to the other of said cylindrical parts, said apron extending in the longitudinal direction of the cylindrical parts, being spaced inwardly from the inner opposite surfaces of the cylindrical parts and being of such length that the bearing surface of the ring is longitudinally spaced from the said means, whereby the apron is free to yield under the pressure exerted by one of the cylindrical parts.

2. A packing according to claim 1 which comprises an apron having a length between its ring and the means connecting the apron to the other of said cylindrical parts which is at least $\frac{1}{10}$ of its interior diameter.

3. A packing according to claim 1 which comprises a ring having an inclined bearing surface which, when the packing is inserted in the annular space, the surface lies flat against the cylindrical surface along its entire longitudinal length.

4. A packing according to claim 1 which comprises a flange integral with the apron, said flange being of such diameter that it is shrunk onto and securely attached to one of the cylinders.

5. A packing according to claim 1 which comprises an apron integral with one of the cylinder parts, the ring bearing against the other cylindrical part.

6. A packing according to claim 1 which comprises an annular groove in the exterior surface of one of the cylindrical parts, an outwardly projecting and tapered surface on the cylindrical part longitudinally spaced from the groove, said packing having a flange longitudinally spaced from the ring arranged to fit into the groove after the flange is expanded on being pushed longitudinally over the tapered surface until it assumes a position inside the groove.

7. A packing for the space between the jacket and cylindrical liner of an internal combustion engine which comprises a ring which bears against a cylindrical surface of the jacket, an apron for the packing integral with the ring and extending an appreciable distance in the longitudinal direction of the cylinder liner, and means longitudinally spaced from the ring securely connecting the apron to the cylinder liner.

8. A packing for the space between the jacket and cylindrical liner of an internal combustion engine which comprises a ring bearing against the exterior cylindrical surface of the cylinder liner, an apron integral with the ring, means securely attaching the apron to an exterior cylindrical surface of the jacket, said apron being spaced inwardly and out of bearing contact with the adjacent cylindrical surfaces of the jacket and cylinder liner and extending such a distance in the longitudinal direction of the axis of the cylinder liner as to provide such flexibility that pressure exerted on the ring does not deform the cylindrical liner.

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