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54 A sealing band for pressurized fluid piston-cylinder devices.

57 A steel sealing band for use in pressurized-fluid piston-cylinder devices of the kind which comprise a cylinder having a circular or oval cylinder barrel and incorporating a longitudinally extending slot through which a dogging element mounted on a piston movable in the cylinder extends. The slot is closed on

both sides of the piston with the aid of the steel band (5) which extends through the piston, and the piston is provided at each end thereof with a sealing cuff. The steel band (5) presents chamfers (9) along its edges on both sides of the band.

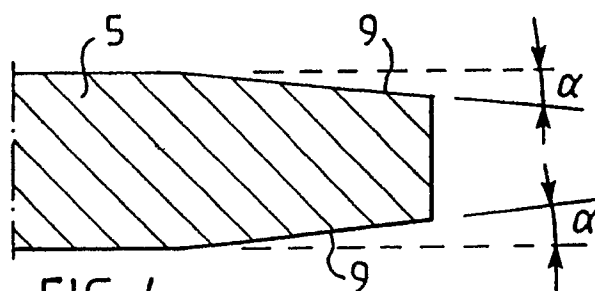
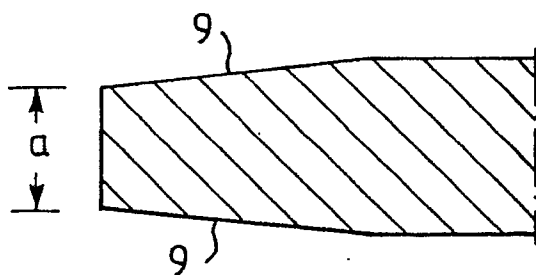


FIG. 4

A SEALING BAND FOR PRESSURIZED-FLUID PISTON-CYLINDER DEVICES

The present invention is concerned with a solution to the problem of effecting a seal between the cylinder and sealing band of a piston-cylinder device which is driven by pressurized fluid and which is of the kind defined in the preamble of Claim 1.

Such piston-cylinder devices and associated sealing arrangements are known from Swedish Patent Specification No. 7807609-8 and Swedish Patent Application No. 8704828-8, for instance.

The primary problem which totally overshadows this kind of piston-cylinder device resides in achieving a fully satisfactory seal in the slot between the band and the cylinder wall. The type of pressurized-fluid piston-cylinder devices to which the invention relates, the so-called "Origacylinder" has been available on the market for twenty years, but in spite of continuous endeavours and improvements, no success has been achieved in obtaining a completely satisfactory or near satisfactory seal. It is emphasized here that the sealing band concerned is a steel band, which has properties that are superior to the properties of bands that are made of some other material, for instance a plastic material, although it is, of course, easier to obtain an effective seal with a plastic band.

According to the aforesaid Swedish Patent Specification No. 7807609-8, the band is chamfered or bevelled on its inner surface towards the edges thereof, while the inner surface of the cylinder, on both sides of the slot, is configured with a cylindrical surface having a curvature which is smaller than the curvature of the remainder of the cylinder. Although this configuration goes some way towards obtaining an improved seal, it is nevertheless not fully satisfactory and, furthermore, the need to provide the cylinder walls with mutually different radius of curvature makes manufacture more expensive.

Similar to the aforesaid Swedish Patent Application No. 8704828-6, the inventor has approached the problem by camfering the band towards its edges on the side of said band which faces towards the cylinder wall, while providing the cylinder barrel with a flat part on both sides of the slot, these flat parts coacting with the camfered edges of the band. This provides an improved seal while, at the same time, the band is guided into correct abutment with the edge surfaces of the slot. This solution, however, also renders manufacture of the piston-cylinder device more expensive, due to the variation in the configuration of the cylinder barrel.

Because in earlier solutions the band has been ground along the edges thereof to a suitable edge thickness on only one side of the band, a relatively

large amount of material is machined-off along a relatively broad area of the band. As a result, the sealing band is less resistant to bending in its transverse direction at the high pressures which prevail in the cylinder, therewith resulting in excessive bending with subsequent leakage of the pressurized fluid.

This primary problem of achieving an effective seal between cylinder barrel and sealing band in such pressurized-fluid piston-cylinder devices is solved in accordance with the present invention by the method set forth in the characterizing clauses of respective Claims. The invention renders it unnecessary to configure the cylinder barrel with a curvature radius which differs from the remainder of the cylinder in order to achieve a fully satisfactory seal, while at the same time obtaining a high surface pressure along the sealing edges of the band, therewith reducing the risk of fluid leakage.

Because the sealing band is clipped from broader sheet-metal strips, displacement of material takes place along each of the edges. Such material displacement has the form of a rounding or "radius" on one side of respective edges and a pointed collaring or "burr" on the other side of said edge. These displacements of material along both edges of the band can be directed either in one and the same direction or in mutually opposite directions, depending on the clipping or shearing method used. When practicing the present invention, all edges of the band will be worked, which means that no such "radius" or no such "burr" will be present on the finished band. This enables a complete seal to be obtained in comparison with hitherto used techniques, in which one side of the band is not worked and has either comprised the sealing side against the cylinder wall or against the sealing cuffs of the piston, in which case gaps and discontinuities are readily formed by the presence of said "radii" or "burrs" promoting leakage.

Because, in accordance with the invention, the steel band is bevelled along the edges on both sides of said band, it is not necessary to grind away as much band material as that which is ground away with a band which is ground solely on one side and with the use of substantially the same grinding angle. In order to grind the edges of a band of given thickness down to a height of at most 0.08 mm, in particularly a thickness of between about 0.04-0.07 mm, and at the same grinding angle of about 5°, it is only necessary to grind away half as much band material as that which is ground away from a band whose edges are ground solely on one side of the band. This affords a technical advantage in manufacture, which shall be

added to the good sealing properties of the band.

The invention will now be described in more detail with reference to an exemplifying embodiment thereof and with reference to the accompanying drawings, in which

Figure 1 illustrates a pressurized-fluid piston-cylinder device of the type intended - a so-called "Origacylinder";

Figures 2 and 3 illustrate schematically and in cross-section two sealing bands clipped from a broader steel band by means of different methods;

Figures 4 and 5 illustrate schematically and in cross-section examples of sealing bands produced in accordance with the present invention; and

Figures 6 and 7 illustrate schematically and in section a known band and a band produced in accordance with the invention, said bands being shown in an unloaded and loaded state respectively.

An example of the pressurized-fluid piston-cylinder device is illustrated in Figure 1, where reference numeral 1 identifies the actual cylinder, while the reference numeral 2 identifies the movable piston which carries a dogging element 3 to which the object or the apparatus to be manoeuvred by the device is connected. The cylinder 1 is configured with a slot 4 which is sealed by a steel band 5 in a known manner. The reference numeral 6 identifies compressed-air connections.

The Swedish Patent Specification No. 388 717 describes in detail the function of the pressurized-fluid piston-cylinder device and also describes the manner in which the sealing band 5 is held sealingly against the slot and extends through the piston beneath the dogging element.

The sealing bands 5 are produced by clipping the bands from a broader, very thin steel band. The clipped bands become deformed along their edges, depending on the method of manufacture, due to the displacement of material such that, with respect to clipping methods, the material is moved in one direction at one edge of the band and in another direction at the other edge of the band, or is also moved in the same direction at the two edges. Figure 2 illustrates the former case, in which there is formed on one side of the band along one edge thereof a rounding or "radius" 7 and along the other edge a pointed projection or "burr" 8. On the other side of the band, there is obtained in a corresponding manner a burr along the first mentioned edge and a radius along the other edge. Figure 3 illustrates schematically a section of a sealing band 5 which has been clipped in accordance with another method, wherewith the band presents radii 7 along its edges on one side of the band and burrs 8 on the other side thereof.

It is also known from the publications recited in the introduction to grind these steel-band blanks along each edge on one side thereof. Consequently, when a blank illustrated in Figure 2 has been ground, one side of the band will still present a radius 7 and a burr 8. This presents serious drawbacks with regard to sealing, irrespective of whether the ground band edges are turned to face towards the cylinder wall or towards the piston. With the clipping method most used at present and resulting in a band blank of the kind illustrated in Figure 3, the band blank is ground along its edges on the side thereof presenting the burr 8. This is indicated on the right of Figure 3. Although the burr is eliminated by this method, the radii 7 remain and when the ground side of the band is turned to face towards the piston, a gap is formed with the cylinder wall, resulting in leakage.

Because the band is ground along its edges on only one side of the blank and because the grinding angle α is a small angle, a relatively large quantity of material will be removed from the band and the band has only a relatively small resistance to bending in its transverse direction, which at high cylinder pressures results in leakage.

Figure 4 is a cross-sectional view of an inventive embodiment of a steel sealing band. The edges of the band are ground down on both sides to a chamfer 9 having an angle α of about $3-7^\circ$. The breadth of the chamfer 9 along the edge of the band 5 is determined by the height extension a of the band edge compared with the thickness of the band. The height extension a of the band edge should suitably be about 0.04 mm.

A comparison of the band cross-section ground in accordance with known techniques according to Figure 3 with the band cross-section according to the invention and illustrated in Figure 4 will show that the band cross-section obtained in accordance with the invention - the obtained beam - presents a greater span with the whole of the band thickness than has previously been the case. This means that the band will have greater flexural resistance and is therewith less likely to bend with the subsequent risk of leakage, as before mentioned.

Figure 4 illustrates in cross-section a band which has been ground symmetrically at angles α to a band-edge height of a . Figure 5 illustrates in cross-section a band which has been ground in accordance with the invention at the angles α to a band-edge height of a but, as illustrated in Figure 5, the upper side of which band has been ground to a shallower depth than in the case of the cross-section illustrated in Figure 4. Figure 5 is solely intended to illustrate the possibility of adapting grinding of the sealing band 5 to different cylinder diameters, and hence it will be understood that grinding according to Figure 5 is concerned with a

sealing band for cylinders of larger diameters than those for which the band illustrated in Figure 4 is intended.

Figure 6 illustrates the manner in which a previously known band, ground solely along the edges of one side thereof, behaves in a non-loaded state (the upper part of the Figure) and in a loaded state (the lower part of the Figure), i.e. when pressure prevails in the cylinder. In this latter case, the band will bend so that the whole of its ground inner surface will come into abutment with the wall of the cylinder 1. Figure 7 illustrates the corresponding conditions for a band which has been ground in accordance with the invention. When an overpressure prevails in the cylinder, since the inventive band is stiffer than the known band the inventive band will bend to a lesser extent and will abut the inner surface of the cylinder 1 solely through its ground edges. A comparison between the known band and the inventive band shows that for a given determined pressure in the cylinder, the sealing surface pressure acting between band and cylinder will be considerably greater in respect of the inventive band than in respect of the known band, which results in a more effective seal between band and cylinder wall in accordance with the invention than that which has previously been possible, as mentioned in the introduction.

It will be understood that the band cross-sections illustrated in Figures 2-4 are not drawn to correct proportions with regard to band thickness in relation to band-edge height a , and that these Figures merely illustrate the principle of chamfering the sealing band 5 in accordance with prior art techniques and in accordance with the invention.

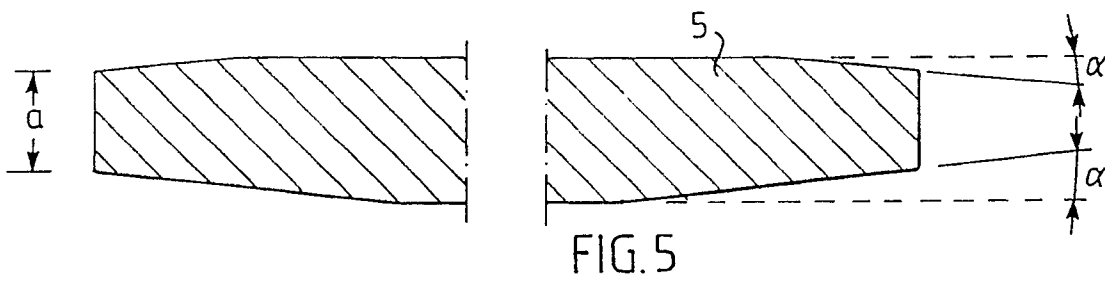
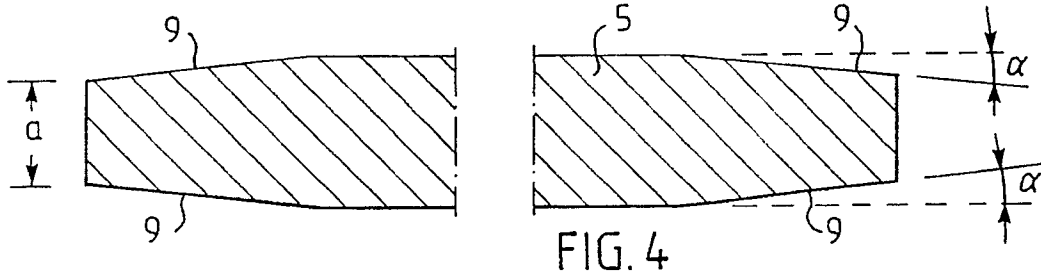
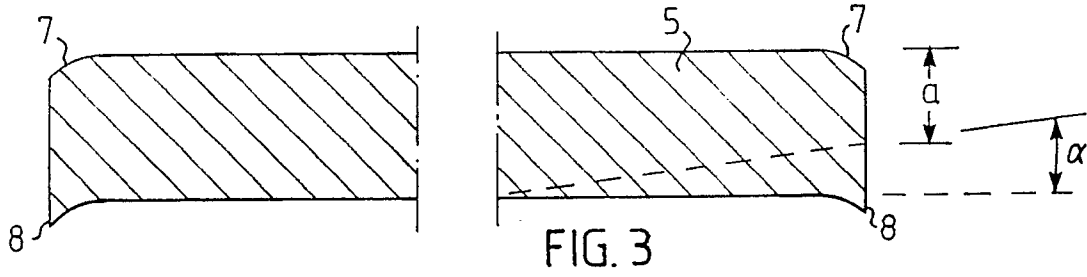
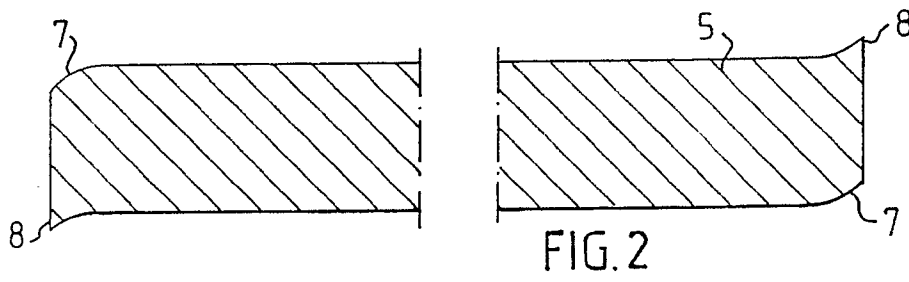
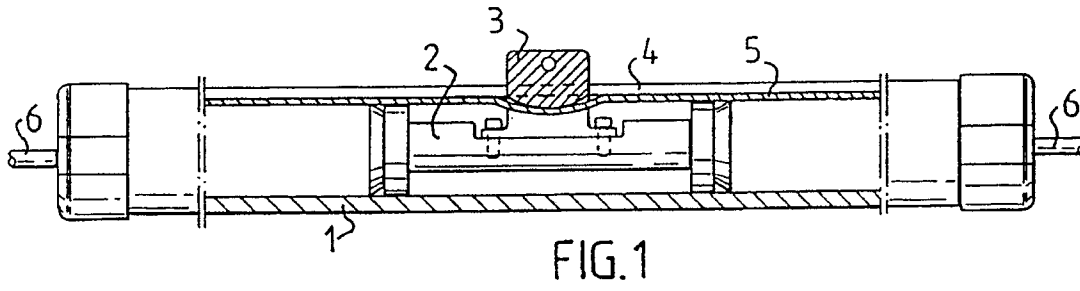
Claims

1. A steel sealing band for use in pressurized-fluid piston-cylinder devices of the kind which comprise a cylinder (1) having a circular or oval cylinder barrel and incorporating a longitudinally extending slot (4) through which a dogging element (3) mounted on a piston (2) movable in the cylinder extends, and in which the slot is closed on both sides of the piston with the aid of the steel band (5) which extends through said piston, and in which the piston is provided on both ends thereof with a respective sealing cuff, **characterized** in that the steel band (5) presents chamfers (9) along its edges on both sides thereof.
2. A sealing band according to Claim 1, **characterized** in that respective chamfers (9) have an inclination of $3-7^\circ$ in relation to the plane of the band (5).
3. A sealing band according to Claim 1 or 2, **characterized** in that the edges of the steel band

(5) have a height dimension of about 0.04 mm - 0.07 mm.

4. A sealing band according to any one of the preceding Claims, **characterized** in that the chamfers (9) on one side of the band (5) are equally as large as the chamfers on the other side of the band.

5. A sealing band according to any one of Claims 1-3, **characterized** in that the chamfers (9) on one side of the band (5) differ in size from the chamfers on the other side of the band.



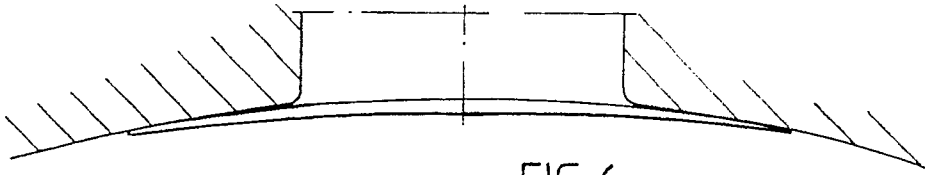
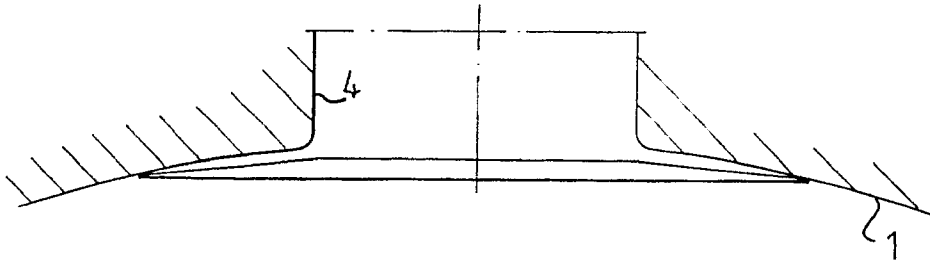


FIG.6

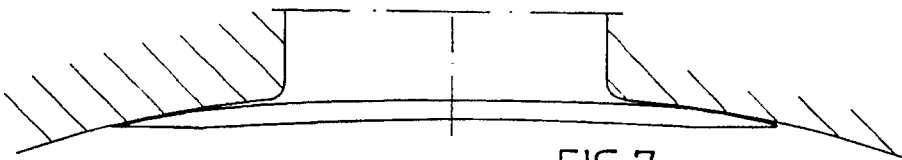
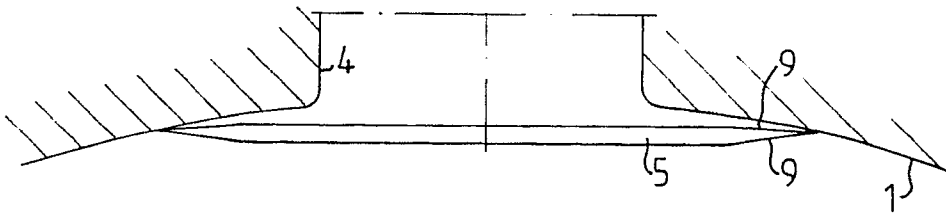


FIG.7