A SIMPLE SEAL FOR THE SMALL PISTON OF A PRESSURE BOOSTER

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The author proposes a seal for use at pressures of up to 20 kbar, which reduces to zero the pressure remaining in the cylinder after the load has been removed from the piston.

With seals of the conventional type [1-3] a residual pressure is left in the cylinder after the load has been removed from the small piston; this pressure makes the dismantling of the device inconvenient, or even hazardous when the experiment involves the formation of a considerable quantity of gas (e.g., during the pyrolisis of the pressure-transmitting liquid). When using the seal shown in Fig. 1, no residual pressure is left in the cylinder.

For assembling the seal, rubber ring 6 is placed onto the curved ring 3 and, after the application of a coat of silicone oil, is moved into the cylinder 4. Thereupon the antiextrusion ring 5 is placed into position, the pressure-transmitting liquid poured into the cylinder, the hole in the curved washer closed by plug 2, and piston 1 mounted in its normal position. All seal parts may be used repeatedly. One advantage of this design is the very simple shape of the piston. The seal has been used up to pressures of 20 kbar, the maximum pressure specified for the apparatus concerned.

If the pressure-transmitting liquid has no swelling effect on rubber (silicone oil), then for reliable sealing up to a pressure of 20 kbar, the rubber ring thickness should be about 1.5 times the size of the gap between the curved washer and cylinder wall. When working with gasoline the compressibility of rubber under pressure is compensated by swelling and a thinner ring may be used. Lubrication of the rubber ring with silicone oil facilitates its introduction into the cylinder and protects the ring when working with gasoline. The rubber plug is only necessary for the initial sealing of the hole (before pressing the rubber ring against the piston face). It is, therefore, sufficient that the plug is only slightly larger than the hole. The plug should be protected against gasoline by a sheet metal ring.

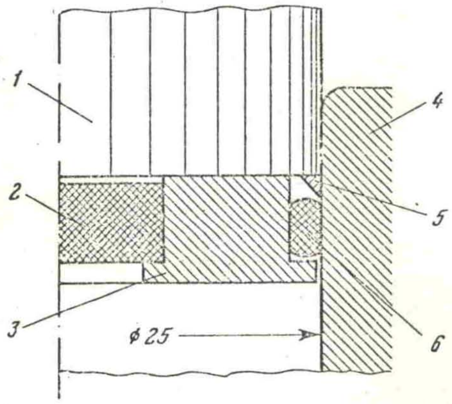

Fig. 1. Seal prior to compression: 1) piston; 2) vacuum rubber seal; 3) curved washer (St. 3); 4) cylinder; 5) extrusion-preventing ring (U7 steel, $HR_C \approx 22$); 6) vacuum rubber ring.

The ring preventing extrusion has a triangular cross section measuring 1 × 1 mm. To reduce friction the ring should be tinned and the tin coat renewed every 3-5 working cycles. Under a pressure of 20 kbar the ring forms a burr of about 0.1 mm when the difference between the cylinder and piston diameters is 0.2 mm. If the seal is to be mounted near the cylinder face (see Fig. 1), the antiextrusion ring is used for centering the piston. For this purpose the ring is a light interference fit in the cylinder, and the parallelism between the cylinder and ring faces is achieved by use of a mushroom-shaped arbor.

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