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SIZING THE CROSS SECTION OF A GAS DISTRIBUTION WITH ROTATING JACKET

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Abstract: *The engine with gas distribution with rotating jacket offers a simple solution of engine distribution with only few, necessary parts. Sizing the gates in the cylinder head and the windows in the rotating jacket for a single cylinder engine and the calculation of the cross sections is done using the model of an engine with valves in the cylinder head.*
Keywords: *sizing intake/exhaust gates, rotating distribution jacket*

1. INTRODUCTION

After modifying an engine with valves in the cylinder head, a single cylinder engine, four strokes, with gas distribution by rotary jacket was obtained. From the engine with valves only some parts were kept: the lower crankcase (who is also oil bath), the crankshaft with its bearings, the flywheel, the connecting rods, piston pin and piston rings. The distribution jacket is placed inside the engine cylinder (fig. 1 element 2) and the piston is moving inside it. Filling the cylinder with fresh charge and evacuating the exhaust gases is accomplished through two windows applied to the top of the shirt and four channels (two for intake and two for exhaust) placed at the top of the cylinder.
The shirt is driven by tapered and cylindrical wheels, firmly attached to the shafts 8 and 9 (figure 1). The cylindrical wheels have tilted teeth to reduce noise and also for the possibility of making a fine adjustment of the distribution.
The tapered wheels reduce by half the revolving speed of the crankshaft and with the cylindrical wheels mounted on the shaft 8 and distribution jacket, the speed is reduced by half again, so that, in the end, the jacket revolves with 1:4 of the crankshaft speed. Also with the wheels 13 and 14 the fuel pump and distributor of oil are driven.

2. SIZING THE CROSS SECTION

Sizing the gates in the cylinder head and the windows in the rotating jacket and the calculation of the cross sections was performed in accordance to the engine with valves in the cylinder head, in order to make laboratory comparisons on the efficiency of exhausting the burned gases from the cylinder and also filling it with fresh load.
Crossing sections were determined after the distribution angles were established, angles that characterize the size of the two windows of the rotating jacket and the four gates of the cylinder, as shown in figure 2.
The linking relations between the angles are:

$$\alpha_C + \beta_A = \frac{\varphi_A}{4} \quad (1)$$

$$\alpha_C + \beta_E = \frac{\varphi_E}{4} \quad (2)$$

where α_C is the angle of the windows opening in the rotating jacket, β_A is the angle of intake gates opening in the cylinder, β_E is the angle of exhaust gates opening in the cylinder, φ_A is the intake length in crankshaft rotating degrees (^{o}CRD), φ_E φ_A is the exhaust length in crankshaft rotating degrees (^{o}CRD).

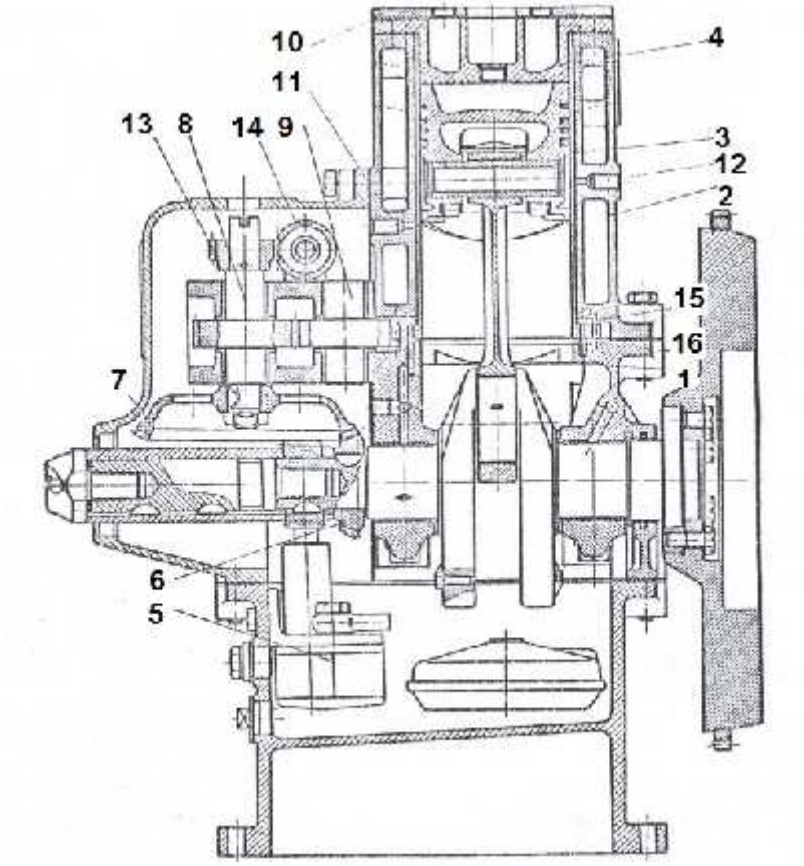

Figure 1. Longitudinal section through the engine with gas distribution by rotating jacket

Because not the distribution angles are critical to achieve the intake and exhaust process, but that crossing sections, the same distribution angles were chosen as the engine with valves in the cylinder head uses: : $\varphi_A = \varphi_E = 246\ ^oCRD$ and $4\gamma = 226\ ^oCRD$, where γ is angle between the middle of the exhaust gate and the intake gate and 4γ is the angle between the middle of φ_A and φ_E at the engine with valves. Also $\beta_A = \beta_E = \beta = \alpha_C = 30^o45'$ was chosen.

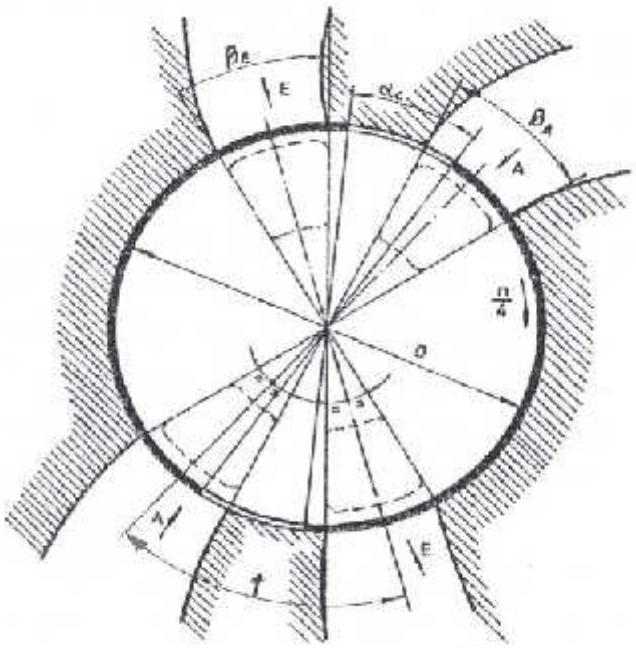

Figure 2. The distribution angles

Cross sections are calculated with the formula:

$$A_b = H \int_{\alpha_1}^{\alpha_2} l d\alpha \quad \textbf{(3)}$$

where H is the height of the cylinder gates respectively of the windows of distribution jacket, *l* is corresponding to the arc length of the gates opening, $\alpha_{1,2}$ are distribution angles of the start and end for the intake and exhaust processes.

3. CONCLUSIONS

Since the arc length *l* varies linearly with the angle of rotation of the crankshaft, the cross section of the distribution jacket can be drawn if the maximum length of arc corresponding to complete opening of the two gates is known:

$$l_{\max} = 2 \cdot \frac{\pi}{180} \cdot \frac{D}{2} \cdot \beta = \frac{\pi}{180} \cdot D \cdot \beta \approx 50mm \quad \textbf{(4)}$$

where D = 97 mm is the cylinder diameter.
Cross sections offered by the distribution jacket for exhaust, A_{eb} and for intake, A_{ab} are the same because the gates of the four channels in the cylinder were sized the same.

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