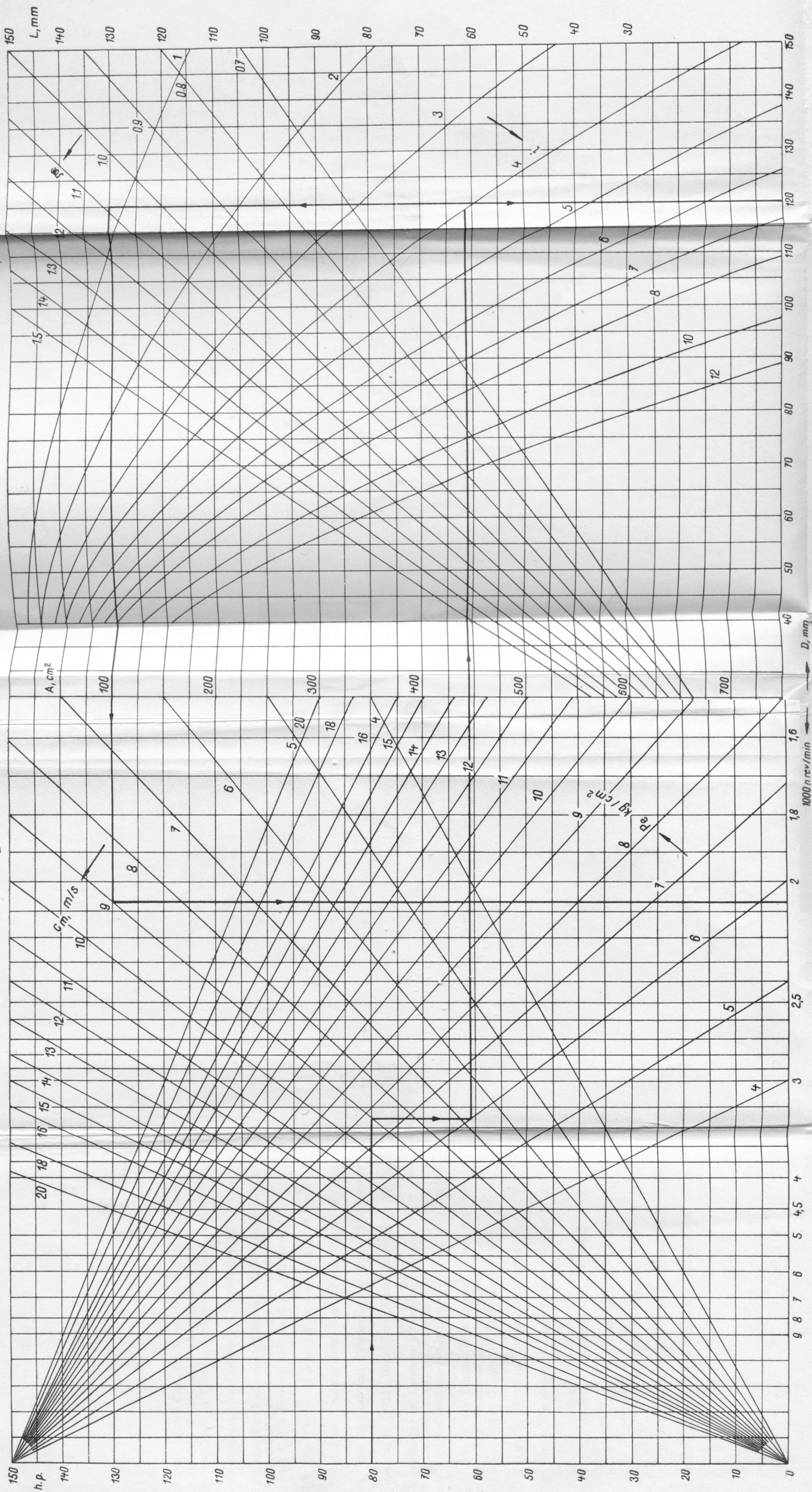




Nomogram for the Rapid Calculation of Internal Combustion Engines

The nomogram represents the graphical solution of equation 41 written in the modified form

$$\text{b.h.p.} = \frac{A \cdot c_m \cdot p_e}{300}$$

The basic nomogram is complemented by an alignment chart for the solution of the relationship between total piston area on the one hand, and bore, stroke and number of cylinders on the other.

The scales, radiating straight lines and curves of the nomogram are marked by the following symbols for the pertinent variables:

- b.h.p. = engine performance,
- c_m = mean piston speed, m/s,
- p_e = mean effective pressure, kg/sq. cm,
- n = engine crankshaft speed, rev/min,
- i = number of cylinders,
- D = bore, mm,

L = stroke, mm,
 ξ = stroke/bore ratio.

Example of use. Let us calculate the dimensions of a compression-ignition engine with the following values given: b.h.p. = 80, c_m = 9.0 m/s, p_e = 6.0 kg/sq. cm, number of cylinders i = 4.

The sequence of operations is shown by the bold line which starts from point 80 on the extreme left vertical scale (b.h.p.). Draw a horizontal line from this point until it intersects the inclined c_m = 9 line. From the intersection draw a vertical line down to the inclined p_e = 6 line. Continue with a horizontal line and read its intersection with the central vertical scale A = 444 sq. cm which is the total effective area of all pistons. Extend the horizontal line and read its intersection with the i = 4 curve as 119 mm for the bore. Select the nearest standard bore, i.e. 120 mm. The intersection of the vertical line drawn through the point D = 120 with the inclined ξ = 1.1 line read on the extreme right hand scale corresponds to stroke L = 132 mm. The stroke/bore ratio ξ = 1.1 has been conveniently selected before-

hand. Take the nearest standard stroke of L = 130 mm, and draw a horizontal line through this point until it intersects the inclined c_m = 9 line. The position of this intersection read on the horizontal scale for n corresponds to an engine speed of 2,080 rev/min.

The calculation may be carried out also the other way round, i.e. with the following values given: D = 120 mm, L = 130 mm, n = 2,000 rev/min, and b.h.p. = 80. The course of this calculation is not drawn in the nomogram. The intersection of the vertical n = 2,000 with the horizontal L = 130 determines the value c_m = 8.7 m/s. The intersection of the vertical D = 120 with the curve i = 4 (selected) determines the total piston area A = 452 sq. cm. Draw a vertical line through the intersection of the horizontal b.h.p. = 80 with the inclined c_m = 8.7 line. This vertical intersects the horizontal A = 452 in the point p_e = 6.1 kg/sq. cm. Dimensions calculated with the aid of the nomogram make possible a rapid orientation during the first phase of the design work. For engines of an output higher than 150 b.h.p. (top of the left hand scale), dimensions are computed likewise, but for one half of the performance and half the number of cylinders.