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STUDY OF CYLINDRICAL GEARS

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ABSTRACT

Familiarization with the basic design of cylindrical gears (blocks, pinion shaft) and their elements (ring gear, rims, disk, hub, chamfers, key grooves), types of external and internal gears (straight, curved, chevron gear), ring gear and with the parameters of other elements. Measurements and calculations of geometric parameters of gears using conventional measuring instruments.

RESULTS:

The design of the gear wheel can be straight (Fig. 6 a, b) or linear angle (Fig. 6, c); in rare cases, gears are made with double-sided hubs. Almost any gear includes the following elements: 1 ring gear, 2 rims, 3 disk, 4 hub, 5 a hole mounted on the shaft, 6 a key or spline grooves.

The gear is considered to be the main element of gears and wheels because the main function of the gear is carried out by these teeth. In small-diameter gears, which are located in the rim and are attached to the hub using toothed crown disks, the rim disk and hub are made in one piece (Fig. 6, a). The outermost element of the hub of a narrow gear (if 1<b) determines the location of the wheel in the shaft, and the outermost element of the toothed ring rim is used to fasten the workpiece in the process of cutting a tooth. Therefore, they are manufactured with high precision.

To reduce the volume of precision mechanical processing, grooves with a cavity of 1…….2 mm are cut into the disk of a narrow gear wheel (Fig. 1 b, c). In order to reduce the weight of gear wheels with a large diameter, to save the material produced and reduce its cost, a hole will be made between the rim and the hub. The rim with a toothed rim and the outer chamfers of the hub are trimmed.

If the direction of the tooth corresponds to the pitch of the cylinder, then the wheel is called a cylindrical spur gear. Teeth of a crooked gear wheel be located with the wheel axle forming a certain angle β. But despite this, crooked gears are also trimmed with a rack that trims straight teeth. To do this, the cutting tool is bent according to the required angle inclination β tooth. Thus, the tooth shapes taken along the vertical section of the teeth (that is, the module) correspond to straight gears. In some cases, curved gears can be made in pairs, that is, two crowns are cut for one rim.

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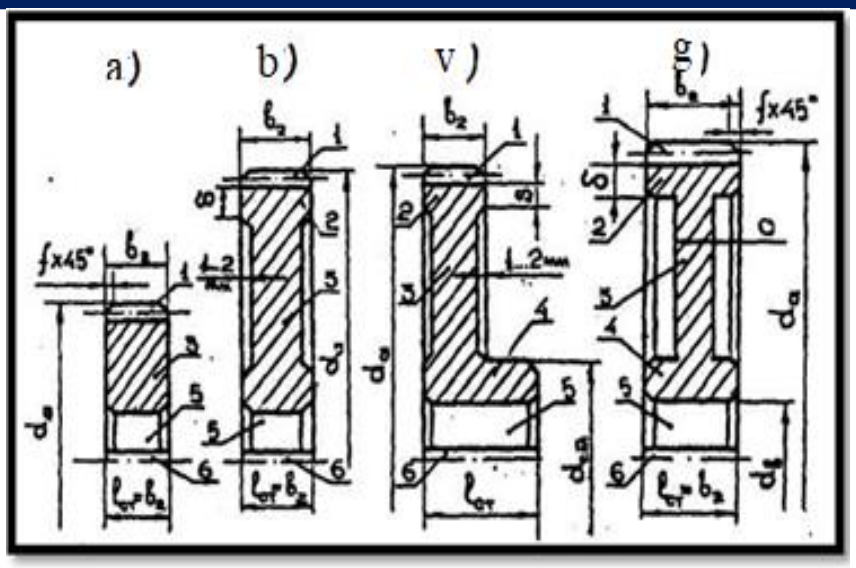

Rice. 6. Common design types of gears:
a) flat, b) with a smooth cavity, c) with an elongated hub,
d) with a dislocation on the disc.

Such wheels are called herringbone gears. They differ from other cylindrical wheels in terms of width and manufacturing with a groove in the cutting process to guide the hob cutter.

Wheels containing two, three, four ring gears with different diameters are called gear blocks. They are often used in gearboxes of technological machines and in most cases the gear blocks are mounted on splined shafts. Because these shafts ensure the shift of gear blocks in the direction of the wasp.

Gear shaft. Gear gears can be made according to two design options: together with the shaft - the gear shaft and separately installed gears. Gear shaft is considered one of the more advanced designs. Therefore, in most cases, the gears of the gearbox are made in one piece with the shaft. In the manufacture of gear shafts, the teeth are cut in the shafts, so special places are left on the structure for cutting the teeth or the teeth are cut on a flat surface of the shaft.

Main parameters of gears

The main parameters of gears include:

Normal tooth modulus - $m = \frac{P_n}{\pi}$,

Normal tooth pitch - P_n,

Tooth circumference pitch - $P_1 = \frac{P_n}{\cos\beta}$,

Modulus of tooth circumference - $m_1 = \frac{m_n}{\cos\beta}$,

Slope of tooth line angle - β,

Number of teeth - Z,

Pitch circle diameter – $d = m_t.Z$,

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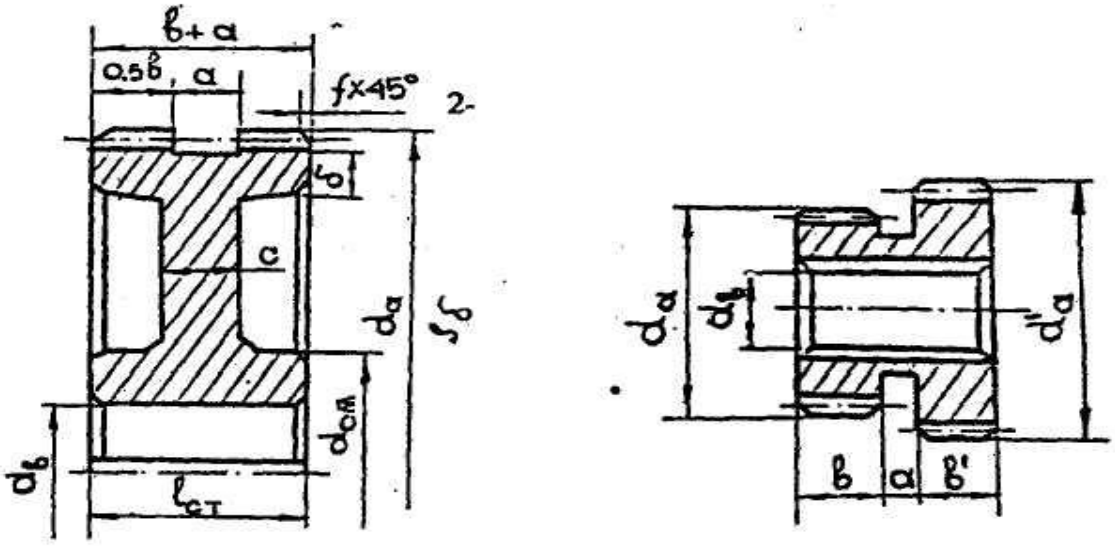
Prong height - $h = 2{,}25 \cdot m_n$,

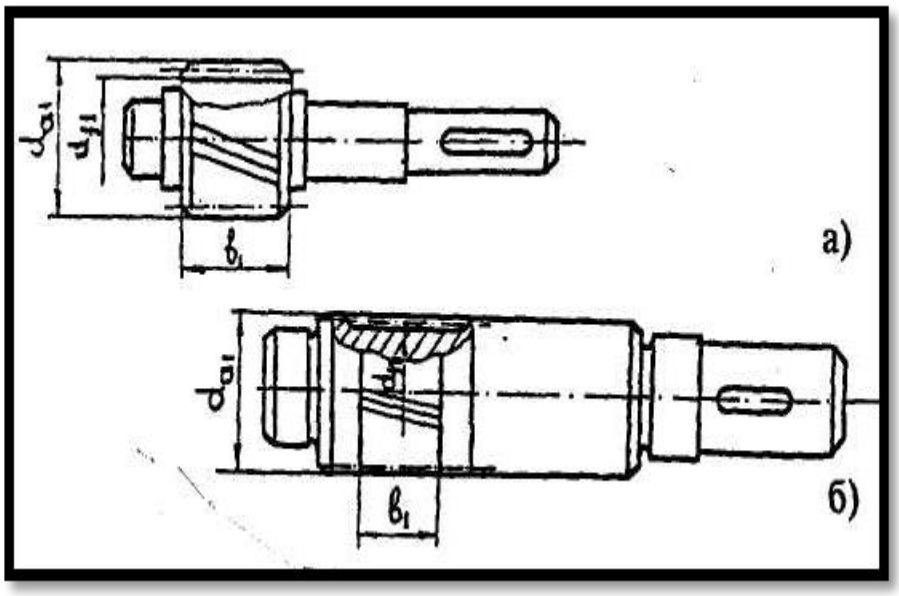
Tooth head circumference diameter - $d_a = d + 2m_n$,

Tooth stem circumference diameter - $d_f = d + 2{,}5m_n$,



Rice. 7. Gear block design

Design options for the gear shaft are shown in Fig. 8.



Rice. 8. Design options for gear shafts:

a) cylindrical, teeth arranged through.

b) cylindrical gear, cut to the surface of the shaft.

ST-SEV 310-76 according to the state standard is given in Table 2.

table 2

Cog module values

Rows	Rows Modulus of teeth, mm
1	1; 1,25; 2;2, 25; 3;4; 6;8; 10; 12; 16; 20; 25
2	1,25; 1,375; 1,75; 2,25; 3,5; 4;5; 5,5; 7;9; 11;14;18; 22

DISCUSSION:

1. A sketch drawing of various cylindrical gears (blocks, pinion shafts, etc.) is drawn and their main structural elements are given (ring gear, rims, disk, hub, chamfers, key dislocations, etc.).

2. Data is presented on the types of external and internal gearing (straight, crooked, chevron gear), ring gear and other elements.

3. Using conventional measuring instruments, the geometric parameters of the gears are measured, based on the calculated results made using these formulas, Table 3 is filled in:

TN№	Defining parameter	Definition	Unit measure	Calculation formula	Measurement results
1	2	3	4	5	6
1	Tooth head diameter	D_a	мм	measured	
		D_o	мм	measured	
2	Riminner diameter	$Б_o$	мм	measured	
	Rim thickness	d_f	мм	d_f=d -2.5 mn	
3	Tooth stem	β	градус	measured	
4	diameter	m_n	мм	mn =0.5/2.25	
	Teeth angle	m_n	мм	ST SEV 310-76	
5	inclination	Z	дона	Counted	
	Normal module	d_1	мм	d_1=mz	
6	Standard normal	b_r	мм	measured	
	module	C	мм	measured	
7	Number of teeth	$1_{ст}$	мм	measured	
8	Pitch diameter	$d_{ст}$	мм	measured	
9	Prong crown width	$d_в$	мм	measured	
	Disc thickness				
10	Hub length	$B_{ш}$	мм	measured	
11	Hub diameter	$b_{ш}$	мм	measured	
12	Hole diameter for	$d_{отв}$	мм	measured	
13	installed shaft				
14	Key dislocation				
15	cavity				
	Key dislocation				
16	width				
17	Disc hole diameter				

A sketch drawing of a gear is shown in Fig. 9.

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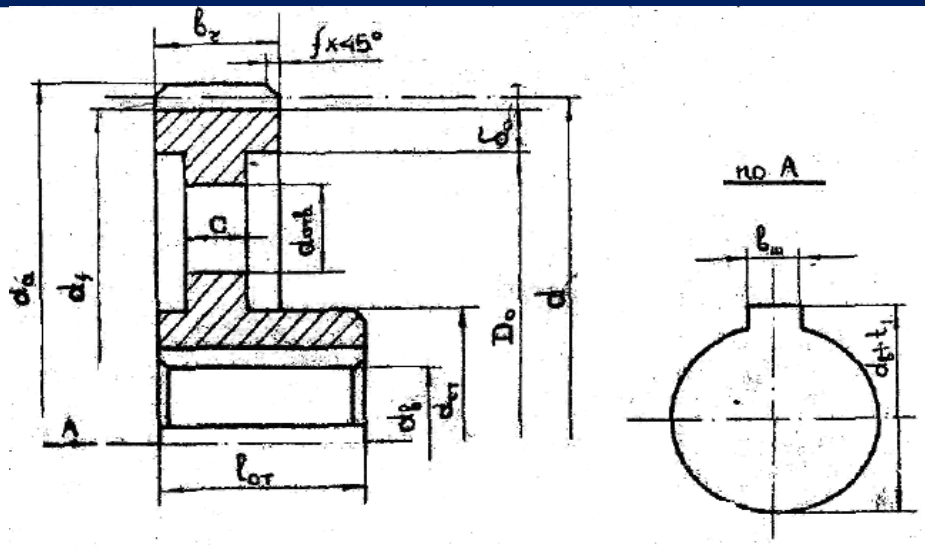

Fig. 9

CONCLUSION:

Laboratory equipment: Toothed cylindrical wheels with different (5-6 types) design forms (straight, crooked, chevron gear, blocks, pinion shaft, keys and others), posters, diagrams, a set of keys, a metalwork ruler (0-300 mm) , calipers (0-300 mm), calipers, angle meter or protractor, educational literature and others.

Contents of the work: Study of gears, the design of the main parts of gears. Typically, when engaged, a small gear in one pair is called a gear, and a large gear is called a wheel. If both wheels work equally, then it is called a drive gear, a driven wheel. Gear is a general term.

Work order

1. Inspect the external output of the gear wheel, become familiar with its design, and determine the types of wheels. Write the inspection results on the report.

2. Draw a sketch of the gear presented by the teacher, pay attention to the design of its elements (ring gear, rim, disk, hub, hole for the shaft, key locations, chamfers). Show measured and calculated parameters on a sketch drawing.

3. Take the measurements shown on the drawing in this wheel and determine the following:

a) diameter of the tooth head - d_a;

6) ring gear width - $b_г$;

г) key ejection cavity $d_в+t_1$ and width $b_ш$;

5) length –$1_{ст}$ and diameter $d_{ст}$ hub;

6) rim thickness δ_0;

7) rim inner diameter -$Д_о$;

8) disc thickness – C;

9) disc hole diameter $d_{отв}$ if they exist;

10) chamfers.f_x=54°.

4. After writing the marks of the tooth head using a protractor or angle meter, measure the angle of inclination - β traces Include the measured value from the report in the table.

We will write a report on the work done.

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