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Gear Transmissions

Nurova Oliya Salomovna
Dotsent, Karshi Engineering and Economic Institute, Karshi, Uzbekistan

Abstract: In this article, the role of lecture training and the methodology of conducting it in preparing students for scientific and research activities based on the teaching of general professional subjects are considered. procedure has been developed.

Keywords: lecture exercise, gear, gear, involute, module, cylindrical, power, gear wheel.

Introduction. In the article, using the design method, students will receive the necessary information about the main parameters of gears, useful work ratio, transmission ratio, runs, calculation of kinematics of drives, geometry and kinematics of gears, types of tooth abrasions, working capacity of gears and criteria for their calculation, accounting loadings, materials used in gears and types of thermal processing, as well as**.**

The purpose of the lesson: to gain an understanding of the types of gears, areas of use, advantages and disadvantages. Geometry and kinematics of gears of involute, cylindrical gear wheels. Gear study the materials used to make wheels. Geared. to understand the level of precision in the manufacture of wheels and its effect on the quality of work. Allowable voltages. Understanding Computational Overload Accepted Limitations.

Theoretical part: The mechanism of transmission of movement from one shaft to another by means of gear wheels is called gear transmission.

At the same time, gears with a diameter of less than 1 mm are used in precision tool making, and in heavy industry, they can be seen with a diameter of several 10 m. In 1760, Euler recommended involute profile teeth.

Advantages:

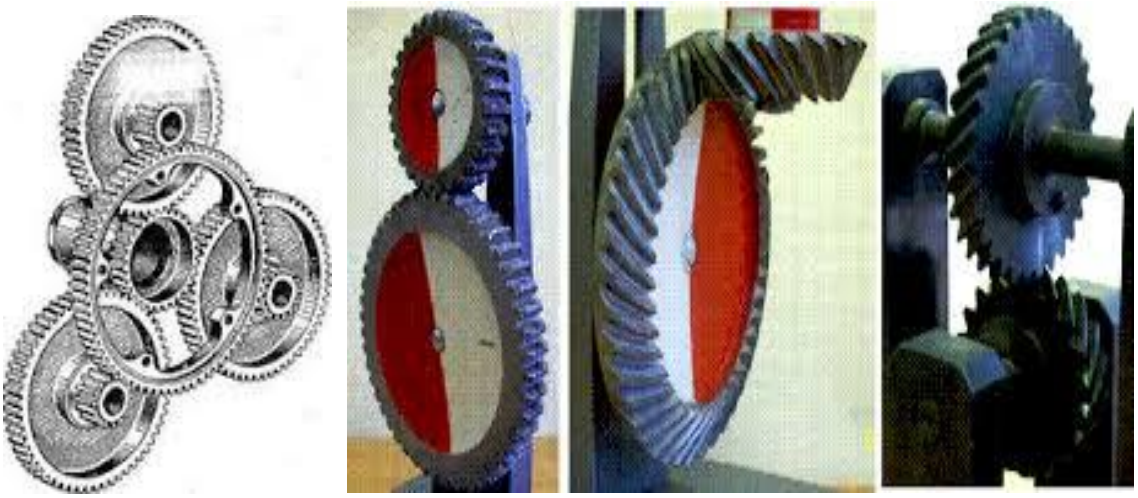
1. It can transmit large (several thousand kW) power at a speed of up to 150 meters per second, and the number of transmissions reaches several hundred:
2. The surface sizes are relatively small:
3. The force applied to the rods will not be so great:
4. The coefficient of useful work is high (0.97...0.98):
5. There will be no sliding phenomenon that will negatively affect the number of transmissions:
6. Allows the use of various materials:

Disadvantages:

1. Relative complexity of preparation:
2. Noise during operation:
3. The damage of impact forces is felt more.

Specific features of bevel gear geometry.

It is recommended to use bevel or chevron gears when the rotational speed in the extension is V>6m/s, because the precision of the spur gears must be very high for them to work satisfactorily at such speeds.



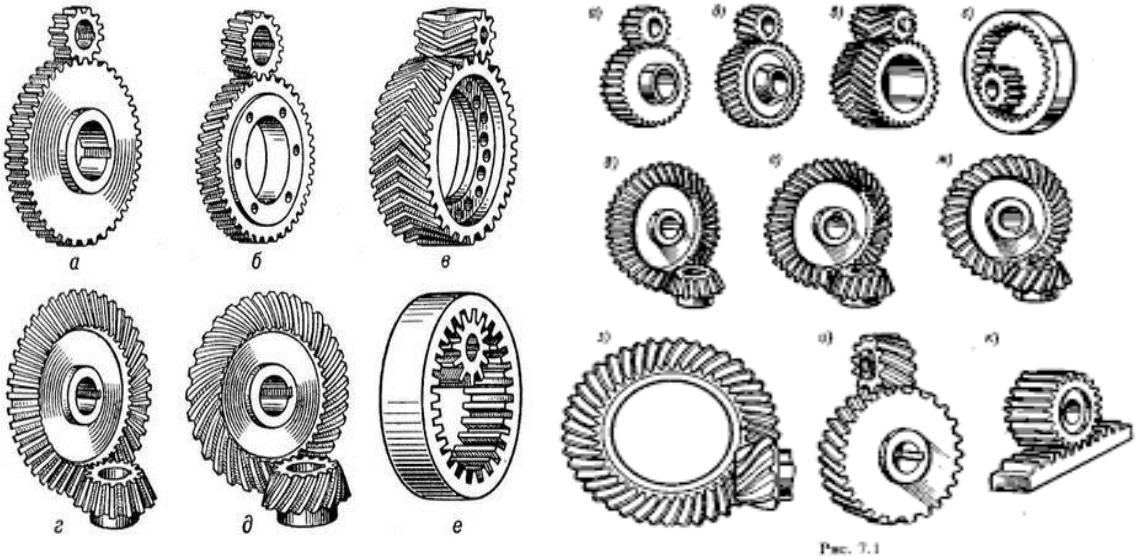
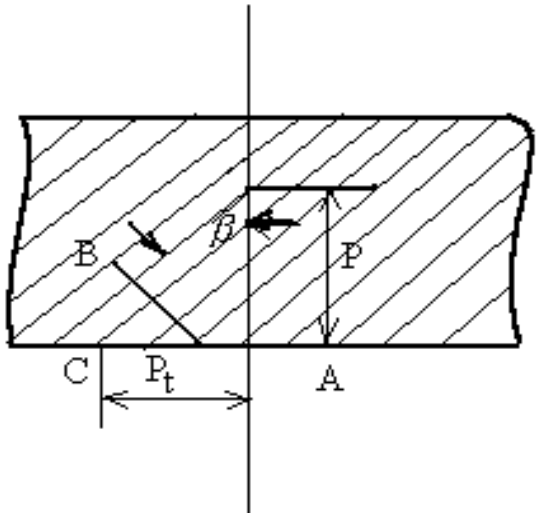
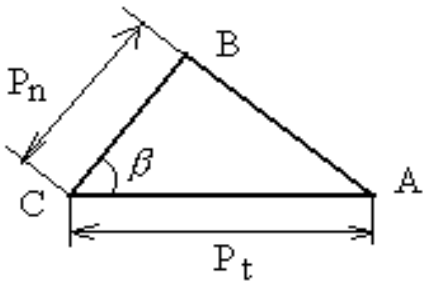


Рис. 7.1





$$m_t = \frac{m_n}{\cos\beta} \quad P_t = \frac{P_n}{\cos\beta}$$

where: m_n - standard module

m_t - side surface module

P_n - a normal step

P_t - side surface step

β - tooth deviation angle.

According to what was said, the dividing diameter of the bevel gear wheel

$$d_0 = m_t z = \frac{m_n z}{\cos\beta}$$

where z - is the number of teeth

Classification of gears.

Depending on the location of the axles, the gears are as follows:

1. Cylindrical - the axes are parallel:

2. Conical - axes intersect under 900:

3. Worm - arrows pass over each other.

Depending on the profile of the teeth, it is as follows:

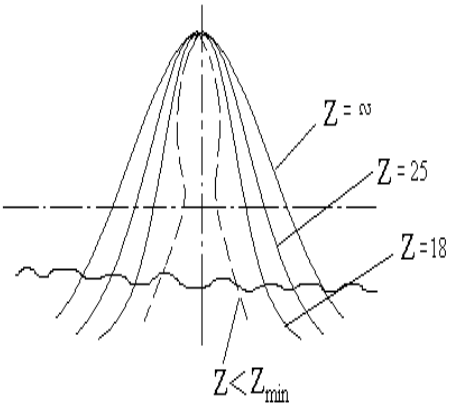
Involute, cycloidal, Novikov gear.

There are 2 types depending on the bite:

Internal and external bite.

Depending on its construction, it can be closed or open.

Changing the shape of the tooth by moving the tooth cutter.



23-расм

In order to prevent the weakening of the strength of gears with few teeth, the shape of their teeth is shown in Fig. 23.

In order to reduce the geometric dimensions of the gear, an effort is made to reduce the number of teeth. A decrease in the number of teeth leads to a decrease in the coverage coefficient, which, in turn, leads to a decrease in tooth strength. Usually, this value is as follows. Zmin = 17÷18

Materials used in the manufacture of gear wheels.

Currently, gear wheels are mainly made of steel, cast iron and plastics. Due to the fact that gear wheels are required to be reduced in size when they are used in high-powered machines, most of them are made of different steels, for example, 40, 45, 50, 40, G2, 50G, 40X, 30 XGS and other brands of steel. It is better to make the wheels of the transmissions, which are affected by impact and work under the influence of the force, which changes direction or speed, 18 XGT, 20 X2N4A, 15X, 20X, 12XZA.

The performance of gears and their wear.

There are two main forces acting on teeth in contact.

One of them is the force directed perpendicular to the involute surfaces of the teeth along the contact line A1, A2.

The second is the frictional force created by the sliding phenomenon between the teeth:

Among them, the main stresses that determine the ability of teeth to work are the contact stress generated on the surface of the tooth and the bending stress generated at the bottom of the tooth.

The erosion of the surface of the teeth should be understood as follows.

a) Fainting due to fatigue.

b) Erosion in an environment with abrasive particles and under conditions of normal friction.

c) Cases of one wheel tooth breaking off the surface and sticking to the surface of the other wheel tooth in transmissions working with heavy load:

d) displacement due to plastic deformation:

e) cases of migration of the surface hard layer of thermally treated teeth.

In gear transmission, one wheel tooth is formed by meshing with another wheel tooth. Keeping the number of revolutions constant ensures the theory of gearing.

In Biting Theory.

$$i = \frac{\omega_1}{\omega_2} = \frac{r_2}{r_1} = const$$

where: - angular velocity of the gear

- angular speed of the wheel
- turning radius of the gear
- turning radius of the wheel.

The dividing circle is used as a basis for determining the geometric dimensions of tooth elements. The following equation can be written for the length of this circle on each wheel:

$$\pi d = z\rho_t$$

where: z is the number of teeth on the wheel:

Pz - tooth pitch:

d - the diameter of the dividing circle.

Rotation speeds of point C relative to centers O1 and O2.

$$V_1 = O_1 S\omega_1 \; v_2 = O_2 S\omega_2$$

We use the analogy of the triangle AEC and BCO1, i.e :

$$\frac{V_1^1}{V_1} = \frac{O_1 B}{O_1 S}$$

from here: $V_1^1 = \frac{V_1}{O_1 S} O_1 B = \omega_1 O_1 B$

we use analogy:

$$\frac{V_2^1}{V_2} = \frac{O_2 C}{O_2 S}$$

from here: $V_2^1 = \frac{V_2}{O_2 S} O_2 C = \omega_2 O_2 C$

$V_1^1 = V_2^1$ in that case $\omega_1 O_1 B_1 = \omega_2 O_2 C$

number of laps: $i = \frac{\omega_1}{\omega_2} = \frac{O_2 C}{O_1 B}$

$\Delta O_2 pC \quad ва \quad \Delta O_1 pB$ using

$$\frac{O_2 C}{O_1 B} = \frac{O_2 P}{O_1 P} = \frac{r_2}{r_1}$$

in that case $i = \frac{\omega_1}{\omega_2} = \frac{r_2}{r_1} = const$

Contact $[\sigma_н]$ and in bending $[\sigma_F]$ permissible values of voltages.

$$[\sigma_H] = K_{HL} [\sigma_{H0}] МПа$$

$$[\sigma_F] = K_{FL} [\sigma_{F0}] МПа$$

here: $\lfloor\sigma_{H_0}\rfloor$; $\lfloor\sigma_{F0}\rfloor$ The value of - is taken from the table in relation to the material of gear wheels, their thermal processing and the size of the tooth surface.

; - coefficients that take into account the service life of the transmission.

$$[\sigma]_H = \frac{\sigma_{H\lim} K_H}{[n]}, \qquad \sigma_{\text{Hlim}} = 2\text{HB} + 70$$

The main dimensions of the extension.

1. Distance between axles.

$$a_W = K_a(i+1)\sqrt{\frac{K_{H\beta} T_2}{\psi_a i^2 [\sigma_H]^2}}, \quad мм$$

where: K_a-coefficient of distance between axles (K_a=430 for helical gears; K_a=495 for straight gears

T_2 - torque on the drive wheel shaft, $H \cdot м$;

$K_{H\beta}$ - the coefficient that takes into account the uneven distribution of the load on the tooth surface.

ψ_a - the coefficient taking into account the location of the transmission wheel in relation to the base points in the case of symmetric ψ_a = 0.4...0.5, in the non-symmetric case ψ_a = 0.25...0.4, in the case of the console ψ_a = 0.2...0.25

2. Transmission module.

m=(0.01...0.02)aw, mm

3. The total number of teeth and the angle of inclination of the drive wheels.

The smallest value of the slope angle for bevel gears.

$$\beta_{\min} = azc\sin 4m / в_2$$

The total number of teeth of the extension wheel.

$$Z_\Sigma = 2a_w \cos\beta_{\min} / m$$

$\beta = 8^0 ... 18^0$ must be

4. The number of teeth of the leading and driven gear wheels.

$$Z_1 = Z_\Sigma / (i+1) > Z_{\min};$$

The calculated value of z1 is rounded up for spur gears and for spur gears

$$Z_{\min} \geq 17$$

$$Z_{\min} \geq 17(\cos\beta)^3$$

The number of teeth of the bearing wheel.

$$Z_2 = Z_1 i$$

Rotational diameters of extension wheels.

a) Diameter of the dividing circle.

$$d_1 = m_n z_1 / \cos\beta \,;\; d_2 = m_n z_2 / \cos\beta$$

b) Outer diameter.

$$d_{a_1} = d_1 + 2m_n \,;\; d_{a_2} = d_2 + 2m_n$$

c) Internal diameter.

$$d_{f_1} = d_1 - 2{,}4m_n \,;\; d_{f_2} = d_2 - 2{,}4m_n$$

5. Forces generated in gear transmission.

Circular force: $F_t = 2T_2 / d_2$

Centripetal force: $F_r = F_t tg\alpha \cos\beta$

Longitudinal force: $F_a = F_t tg\beta$

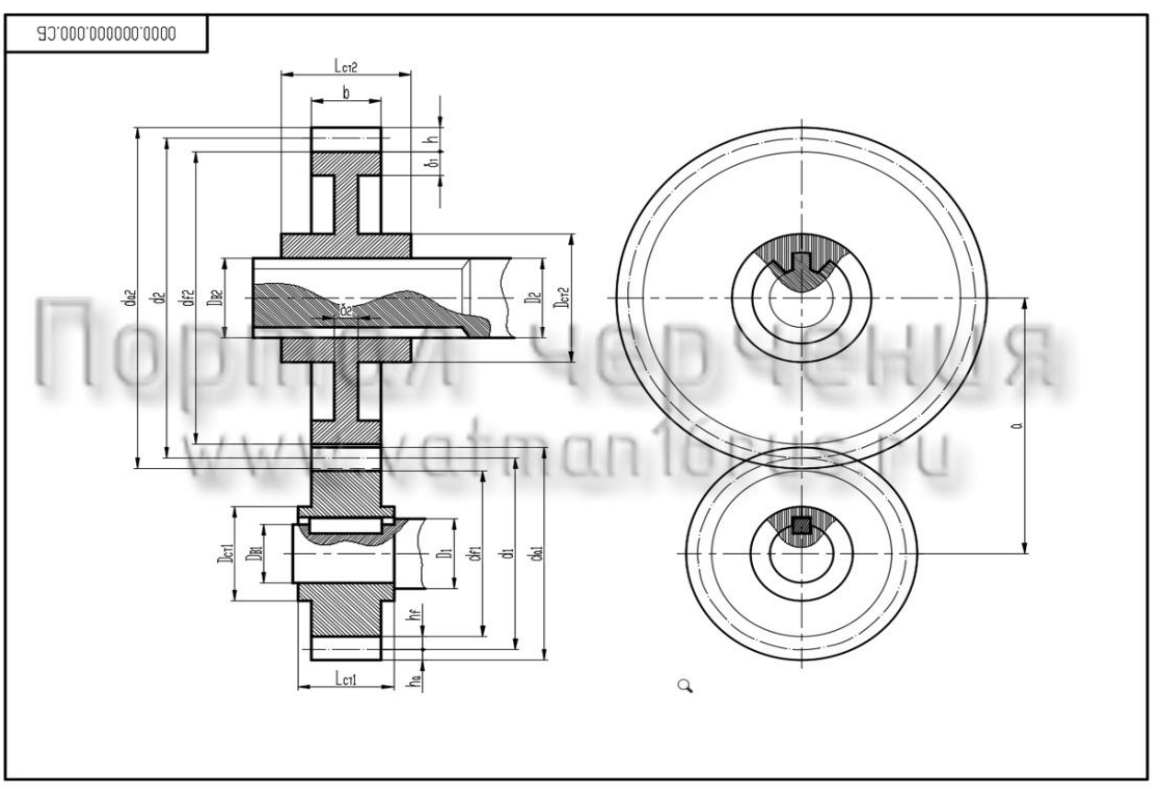
6. Bending stress of wheel teeth.

A) For the driving wheel

$$\sigma_{F_2} = K_{F\alpha} K_{F\beta} K_{Fv} Y_{F_2} Y_\beta F_t \big/ в_2 m, \quad МПа$$

b) For the leading wheel

$$\sigma_{F_1} = \sigma_{F_2} ; \quad \frac{Y_{F_2}}{Y_{F_1}} ; \quad МПа$$



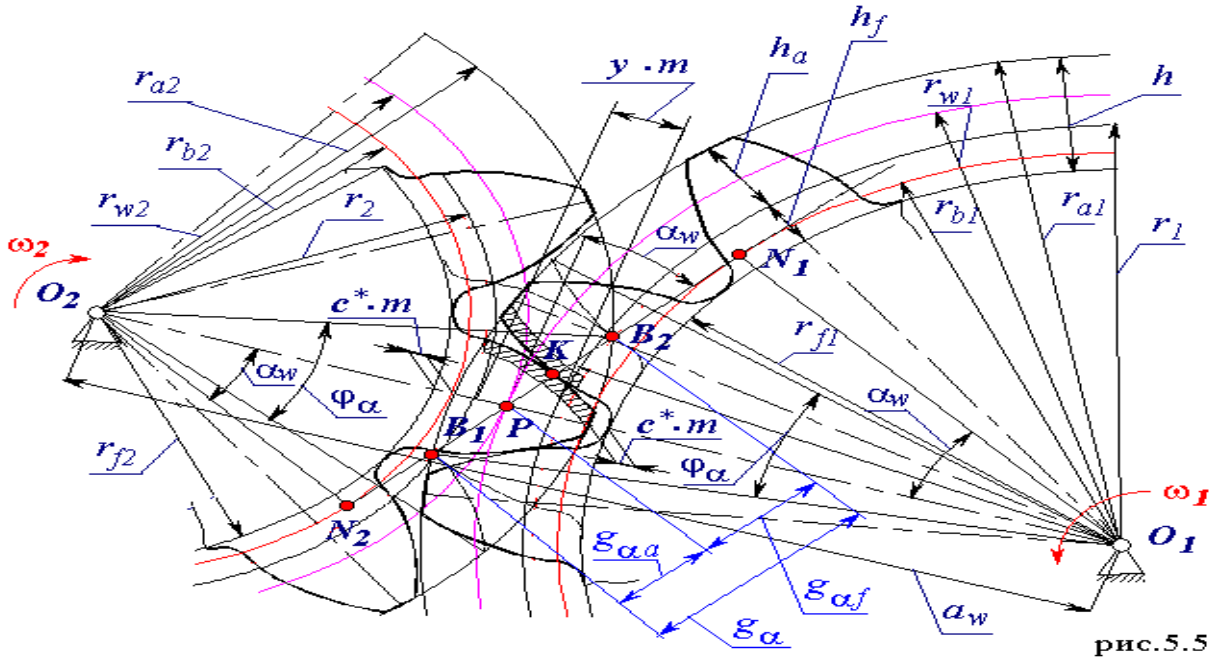


рис.5.5

TECHNOLOGICAL MAP

The fun of each training session depends on the well-thought-out technological map of the training session. The teacher's serious attention to this process leads to the perfect quality of training.

1	Topic:	"Gears"
2	Purpose, tasks	To inform students about the types of gears, their uses, their advantages and disadvantages. To justify the geometric and kinematic parameters of gears of cylindrical gear wheels with an involute profile. To study the materials used to make gear wheels and to test their strength formulas. formation of general skills about application. To understand the degree of accuracy in the

		manufacture of gears and its effect on the quality of work. Organization and implementation of studies on the basis of which parameters are selected based on the parameters of the permissible bending stresses, calculated loading, accepted limitations, and the fields of mechanical engineering. Learning of the distributed materials related to the topic by students individually and in groups, as well as controlling the degree to which the texts in the distributed materials are mastered through conversation and discussion, evaluating their knowledge.
3	Your learning process content	Explaining to students the types of gears, their uses, advantages and disadvantages. Formation of general skills about the types of materials used for the manufacture of gear wheels, how to choose them, and how to use formulas for checking the strength of the materials used. Understanding the level of precision in the manufacture of gear wheels and its effect on the quality of work. Formation of students' skills to understand and evaluate the permissible bending stresses of gear materials, calculated loading and their accepted limitations.
4	Educational process make it happen technology.	Methods: Verbal presentation, brainstorming, "Boomerang", "Cluster", conversation-discussion, SWOT analysis, FSMU, Sinkwain. Tools: Handouts, texts. Technical equipment: computer, projector, electronic board, multimedia tools. Methods: Through drawings, presentation slides. Control: Verbal control, question-and-answer, self-control. Assessment: Teaching self-assessment based on a 5-point system using assessment cards.
5	Expected results	Teacher: The subject is mastered by all students. Increases student engagement. As a result, it forms students' interest in lessons. He will achieve his goal. A student: acquires new knowledge, learns to work alone or in a group, develops speech, and strengthens the ability to remember. Learns self-control and evaluation.
6	The future plans (analysis, changes)	The teacher improves the assimilation of innovative pedagogic and information technologies and their application to classes. He works on himself. Connects the topic with real life examples. Improves pedagogical skills. Student: learns to work independently with formulas, text and drawings, to express his opinion freely. He can solve problems independently on the topic.

The above-mentioned technological map prepared by the teacher for each subject of the subject he is teaching, for each lesson, allows him to imagine and approach the subject as a whole, to understand it, from its purpose to being able to see the results that will be achieved. will help. In particular, the construction of the technological map based on the student's ability and attention brings him as a person to the center of education. This makes it possible to increase the efficiency of studying.

In the process of teaching, students are treated as individuals, various pedagogical technologies and modern methods are used to make them think independently, freely, to research, to feel the responsibility of creative approach to every issue, to carry out scientific research, to analyze, to

make effective use of scientific literature, the most important thing is to increase their interest in studying, science and their chosen profession.

Summary.

Theoretical and practical knowledge about the types of gear transmissions, areas of operation, their materials, stability testing, calculation of geometric and kinematic parameters was formed for students using the methods of pedagogical technologies. the development of the methodology of preparation for service provision and research types was achieved

Literature

1. Д.Н.Решетов « Детали машин» М. Машиностроение.1989й
2. Л.Д.Решетов «Конструирование самоустанавливающихся механизмов» М.Машиностроение.1983г.
3. С.Н.Носиров « Машина деталларидан курс лойиҳасини бажариш” Тошкент.2008.г