USING AN APPROXIMATE METHOD OF SELECTING REDUCER SHAFTS IN PERFORMING A COURSE PROJECT IN THE SCIENCE OF MACHINE DETAILS

Associate Professor **Nazarov Asror Allanazarovich.**
Karshi Engeneering Economical Institute, Karshi, Uzbekistan.

ABSTRACT

The shafts of the machines, which carry the working parts of the machine, except the gear parts, are called main shafts. A shaft that distributes mechanical energy to separate machines is called a transmission. In some cases, the shafts are made as one piece with a cylindrical or bevel gear or worm gear.

Keywords: *transmission, shaft, machine, dynamic balance, reducer.*

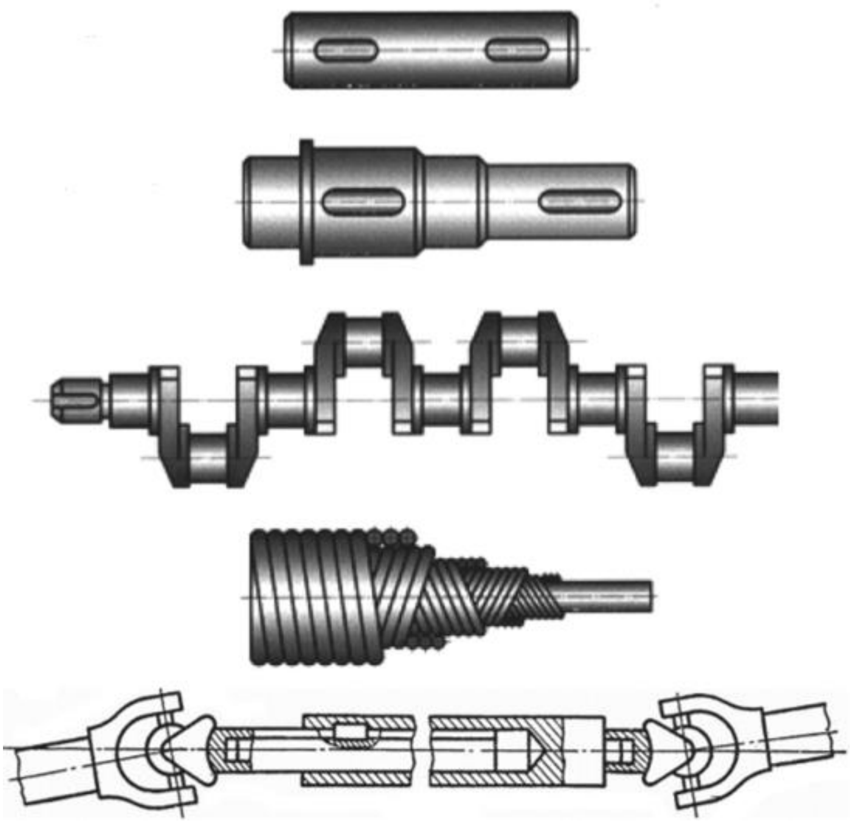
A shaft is a part of a machine or mechanism designed to support the parts installed on it and to transmit torque (pic. 1). During operation, the shaft performs bending and twisting, and in some cases - tension and compression are also performed. Moving parts can interact with moving parts, such as gears with moving parts in a gear train. For example, spherical bearings, which receive the load from the shafts, transfer it to the rigid housing, thereby ensuring the operation of the transmission. This interaction ensures the transmission of torque along the centerline of the shaft.

The shafts of the machines, which carry the working parts of the machine, except the gear parts, are called main shafts. A shaft that distributes mechanical energy to separate machines is called a transmission. In some cases, the shafts are made as one piece with a cylindrical or bevel gear or worm gear.

Crankshafts are used in crank mechanisms. Flexible and cardan shafts are used to transmit motion with frequent changes in the relative position of the nodes connected by a relatively large distance between them.

Custom metal processing allows the production of various types of shafts, taking into account the individual dimensions of the part, the scope of operation and the appearance of the product. The production of shafts consists of several main stages:

- calculation and design of the structure;
- selection of the processed material according to the required parameters of the part;
- turning and sharpening of shaft surfaces;
- welding of separate elements of the shaft and milling of holes in milling equipment;
- final polishing of the structure;
- dynamic balancing of the shaft;
- covering the functional surfaces of the product with a protective layer.



1 - picture. Construction and classification

There are the following material requirements for shafts:

- high fatigue strength (ability to withstand changing loads);

- hardness (has a high modulus of elasticity);
- mechanical processing ability.

These requirements are fully used by carbon and alloy steels. The performance requirements of shafts and axles are best produced by carbon and alloy steels, and in some cases by high-strength cast iron. The choice of material, thermal and chemical-thermal treatment is determined by the appearance of shafts and supports, technical characteristics of the product and its working conditions.

Ct45 and 40KX steels are used for heat treatment for most shafts, and steel 40KXN, 30XGT, etc. are used for important structures. Shafts made of these steels result in high frequency current enhancement or surface hardening.

Usually, the shafts are prone to twisting, so the workpieces are ground. Sometimes shaft surfaces are polished or hardened with surface work hardening.

1. The approximate calculation of reducer shafts is calculated in the following sequence.

As we know, the construction of shafts and axles is calculated mainly in 3 different ways:

- approximate method
- approximate method
- a relatively refined method.

In this course project work, we will consider the use of the approximate method of designing reducer shafts.

In this case, the torque that the shaft can transmit and the bending stress for the material of the shaft must be given.

We get the sequence of determination of the diameter for the drive shaft as follows:

The diameter of the end connecting the drive shaft to the coupling is determined as follows:

$$d_{\vartheta 1} = \sqrt[3]{\frac{16 \cdot T_1 \cdot 10^3}{\pi[\tau]}}, mm \qquad (1.)$$

Where T – torque, $[\tau] -$ permissible torsional stress (for shafts made of St40, St45, 40X steel materials $[\tau] = 15 \dots 25\ MPa$).

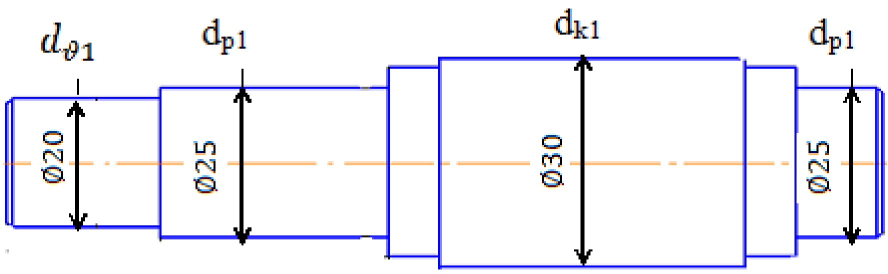
Basically, if we take into account the connection of the reducer and the electric motor to the clutch, $d_{\vartheta} \approx d_{elk}$ that is, they are connected through the clutch, the result is.

$d_{elk} -$ a value close to the diameter of the electric motor rotor is obtained. The dimensions of the electric motor are selected from table 1.1 according to the brand of each one.

So, if we substitute the obtained values, we get the following result.

$$d_{\vartheta 1} = \sqrt[3]{\frac{16 \cdot 35 \cdot 10^3}{3.14 \cdot 25}} = 19.3 \approx 20\ mm \qquad (2.)$$

$d_{\vartheta 1}$ The determined value of is rounded (10; 10.5; 11; 11.5; 12; 13; 14; 15; 16; 17; 18; 20: 21; 22; 24; 25; 26; 28; 30; 32; 33; 34; 36; 38; 40; 42; 45; 48; 50; 52; 55; 60; 63; 65; 70; 75; 80; 85; 90; 95; 100; 105; 110; 120; 125; 130) and the diameters of the remaining parts of the shaft are determined and we draw a sketch of the shaft. The remaining diameters are determined as follows for approximate drawing of the sketch. *This is drawn in pencil.*



2 – picture. Drive shaft construction.

d_{p1} - the diameter of the part where the bearing is installed on the first shaft, mm. This diameter is chosen based on the value of d_{v1}. For example: $d_{\vartheta 1} = 20\ mm$. 20mm is a number ending in 0 or 5. From now on, since the number is closer to 25 or 30 and to reduce material consumption, we will take d_{p1}=25 mm. d_{k1} must be greater than d_{p1}. We can take d_{k1}= 30 mm (26, 27, ...).

In some cases, the movement between the reducer and the electric motor can be transmitted from the clutch to the reducer through belt and chain transmissions. In such cases, d_{v1} is selected according to the conditions of the pulley or star shaft.

2. The intermediate shaft is calculated as follows:

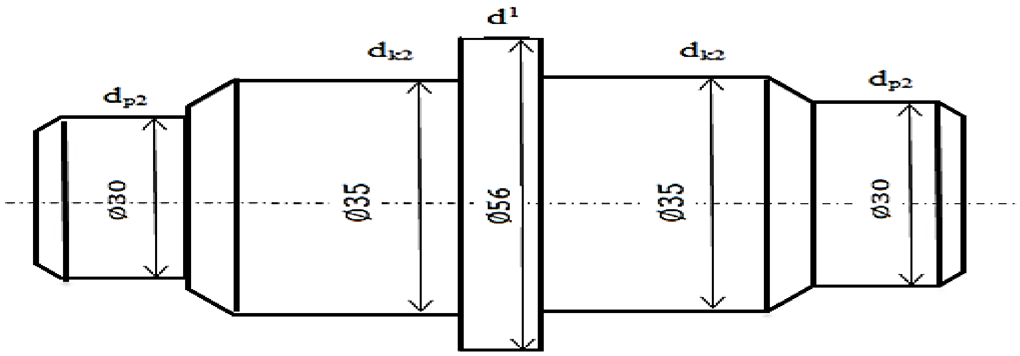
The intermediate shaft serves to transfer torque from the drive shaft to the drive shaft.

$$d_{\vartheta 2} = \sqrt[3]{\frac{16 \cdot T_2 \cdot 10^3}{\pi[\tau]}}, mm \qquad (3.)$$

Substituting the values, we get the following result

$$d_{\vartheta 2} = \sqrt[3]{\frac{16 \cdot 127.4 \cdot 10^3}{3.14 \cdot 25}} = 29.6\ mm \qquad (4.)$$

We assume that according $d_{\vartheta 2} \approx 30\ mm$to the standard.



3 – picture. Intermediate shaft construction

This is the shaft $d_{\vartheta 2} = d_{p2} + 5$, mm

Where, d_{p2} – As the diameter of the bearing on the intermediate shaft is the diameter, the value of is rounded $d_{\vartheta 2} = d_{p2}$ to a $d_{\vartheta 2}$ number ending in 0 or 5 after calculating.

3. The calculation part of the drive shaft is as follows.

$$d_{\vartheta 3} = \sqrt[3]{\frac{16 \cdot T_3 \cdot 10^3}{\pi[\tau]}}, mm \qquad (5.)$$

If we replace all the obtained values, we get the following result.

$$d_{\vartheta 3} = \sqrt[3]{\frac{16 \cdot 648.6 \cdot 10^3}{3.14 \cdot 20}} = 55\ mm \qquad (6.)$$

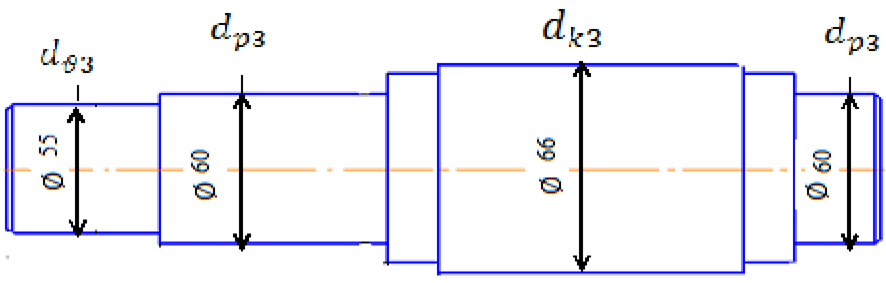


Figure 4. Drive shaft design

For general-purpose reducers, it is recommended to make smooth shafts with the same nominal diameter along the entire length, their design is very simple; to ensure the required fit of the parts, the corresponding sections of the shaft must have the provided deviations. However, if the mating points are located further from the shaft, it becomes difficult to install the parts. Therefore, when assembling and repairing the shaft, for the convenience of replacing bearings and other installed parts, the shafts are stepped. is processed.

LITERATURE

1.Nazarov A.A. Principles of education that develop an innovative approach to engineering professional activities / International Journal of Early Childhood Special Education (INT-JECSE) / [*https://www.iiste.org/journals*](https://www.iiste.org/journals).

2. A.Nazarov and others. Methods for Conducting a Course Project on Machine Parts / TEST INGineering management./ [*https://ejmcm.com/article_3873.html*](https://ejmcm.com/article_3873.html) *May – June 2020. ISSN: 0193-4120 Page No. 26595 – 26598.*

3. Nazarov A. A. Principles of education that develop an innovative approach to engineering professional activities. / European Journal of Research and Reflection in

Educational Sciences. Vol.8No.8,2020 ISSN 2056-5852. / https://www.idpublications.org/wp-content/uploads/2020/07/Full-Paper-PRINCIPLES-OF-EDUCATION-THAT-DEVELOP-AN-INNOVATIVE-APPROACH-TO-ENGINEERING-PROFESSIONAL.pdf.

4. Murtazaev E. M., Nazarov A. A., Nurova O. S. Training of Gears From the Course Machine Parts / https://media.neliti.com/media/publications/337075-training-of-gears-from-the-course-machin-c6b40ed9.pdf.

5. Nazarov A. A. Completion of the course project on the subject "Machine details"./Oriental Renaissance: innovative, educational, natural and social sciences/ https://cyberleninka.ru/article/n/completion-of-the-course-project-on-the-subject-machine-details.