ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 6, Issue 10 , October 2019

Basic Types of Mechanical Transmissions and Their Application

TemirovSh.A., Mirzayev N.N.

Research, Tashkent State Technical University 100095, University str., 2, Tashkent, Uzbekistan;
Senior Teacher, department technique of rendering services, Tashkent State Technical University 100095, University str., 2, Tashkent, Uzbekistan

ABSTRACT: The article describes the main types of mechanical gears and their applications. In most agricultural machines, mechanical transmission is necessary in order to change the torque, direction of movement, speed value, etc. The agricultural transport engine itself cannot change the operating modes of the actuator, since it works unstable with a sharp increase in torque or increase in speed, t .e. in a narrow range of torques and speeds. The working bodies of the agricultural machine are wide. To coordinate the operating modes of the energy machine with the operating modes of agricultural working bodies, mechanical gears are used. Currently, in agricultural engineering, high-speed engines are widely used using a mechanical transmission in a machine or agricultural unit, which reduces the engine speed and increases the torque on the shaft.

KEY WORDS: mechanical gears, wear, flails, agricultural machinery.

I.INTRODUCTION

Mechanical transmission - a mechanism that serves to transfer and convert mechanical energy from the engine to the actuator. In fact, the mechanical transmission in the design of the unit is an intermediate link, which provides the connection of the engine with the executive organs of the machine.

Currently, in agricultural engineering, high-speed engines are widely used using a mechanical transmission in a machine or agricultural unit, which reduces the engine speed and increases the torque on the shaft. The need to increase torque is dictated by the operating conditions and operating conditions of agricultural machines when performing technological operations of soil cultivation, harvesting, etc.

In tractor and agricultural engineering, the following types of gears are used: mechanical, electric, hydraulic and pneumatic. The most widespread are mechanical transmissions, the reliability of which is considered in this paper.
Mechanical gears can be divided into the following types:

- gears (cylindrical, bevel);
- helical gears (helical, worm, hypoid);
- flexible gears (belt, chain);
- friction gears (due to friction forces).

According to the method of transmitting movement from the working machine to the executive body of the transmission can be divided into:

- transmission of movement from shaft to shaft, which are carried out due to friction forces (belt, friction, worm);
- transmission of movement from shaft to shaft, which are carried out by gearing (chain, gear, screw, worm, with timing belts).

Regardless of the design and type of mechanical transmission, two shafts can be distinguished in it, one of which is input or output, and the other output or output.

It should be noted that chain drives are widely used in agricultural machinery and animal husbandry equipment, the main advantage of which is a large load capacity and the ability to work during overloads.

ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 6, Issue 10 , October 2019

The mechanical drive of agricultural purpose differs from the drive of other machines used in the sectors of the national economy by structural and technical and economic indicators due to the operation of agricultural machines, namely:

- seasonality of work during the year, limited by small agrotechnical periods (90-250 h) per year, depending on the type of machine, which leads to an increase in the payback period;
- operation and storage of agricultural machinery in constantly changing difficult soil and climatic conditions (at positive and negative temperatures, rain and snow, in a vegetative and abrasive environment, etc.), which especially affects reliability, availability, maintainability and maintainability;
- uneven load, the occurrence of dynamic loads, which are due to the biological characteristics of the harvested plants, the topography and size of the fields, clogging with stones, etc .;
- minimum costs for maintenance and repair during the period of seasonal work, due to the need to minimize loss of downtime;
- low metal consumption associated with limiting the mass of agricultural machines from the point of view of agricultural requirements.

The above features of the operation of agricultural machines indicate that agricultural drives belong to technical systems, the operation of which is characterized by multiplicity and cyclicity. The life of agricultural machinery is 5-10 years. Therefore, the durability of the drive and its components and parts is 450-2500 hours.

To increase operational reliability, mechanical drive designs use materials with enhanced corrosion, wear, and temperature-resistant properties, as well as wear-resistant coatings and protective seals. In chain transmissions, chains are used whose elements are made of alloy steels with increased hardness and anti-corrosion coating. Most chains are boiled in oil, periodically lubricated for further preservation and storage in the autumn-winter period.

Wedge belts for most wedge belt drives are made of special wear-resistant and oil-resistant rubber-fabric materials. The bearing units of mechanical drives use disposable-lubricated rolling bearings with special seals made of metal-rubber materials, which prevent the penetration of abrasive particles on the surface of the bearing elements and prevent oil leakage.

Gearboxes are equipped with various gaskets for sealing body parts and rolling bearings to eliminate oil leakage, and the fasteners have a corrosion-resistant coating.

Taking into account that downtime of agricultural machines can lead to irreparable losses of agricultural products due to rapidly changing weather conditions during technological operations, designers of mechanical drives tend to provide a minimum of technical service measures during this period. For this purpose, recently applied:

- wedge transmission instead of chain, requiring periodic lubrication and repair;
- closed chain drives in an oil bath instead of the usual open chain drives;
- gear reducers instead of open gears, subject to intense abrasive wear and requiring periodic lubrication;
- Closed-type rolling bearings with seasonal or one-time lubrication instead of open-type bearings requiring regular lubrication, etc.

This increases the likelihood of equipment uptime, reduces the time spent on technical service and reduces the consumption of lubricants.

It should be noted that in view of the limited mass of mobile agricultural machines, designers are constantly striving to find solutions to mechanical drives that would reduce the size and weight. In this regard, abroad and in our country, aluminum is increasingly used as parts of gear cases, sprockets made of sintered plastic and metal, pulleys of smaller sizes and weights, belts of narrow sections, protective shafts of cardan shafts made of plastic, plastic and aluminum pulleys, etc. .P.

II. MATERIALS AND METHODS

The main characteristics of mechanical gears are power N_1 at the entrance and N_2 output W; speed, which is expressed by the speed n_1 at the entrance and n_2 at the exit min^{-1}, s^{-1} or angular speeds ω_1 and ω_2, *glad / s*; $\omega=\pi n/30$; torques on drive and driven shafts T_1 and T_2 (H m). These characteristics are minimally necessary and sufficient for the design calculation of any transmission. In addition to the main, there are also derived characteristics:

1) coefficient of performance (COP):

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 6, Issue 10 , October 2019

$$\eta = \frac{N_2}{N_1} \quad (1.1)$$

2) gear ratio determined in the direction of power flow:

$$i = \frac{\omega_1}{\omega_2} = \frac{n_1}{n_2} = \frac{T_1}{T_2} \quad (1.2)$$

At i>1 and $n_1 > n_2$ – gear or reduction gear. At i<1 and $n_1 < n_2$ - multiplier or overdrive (Figure1).

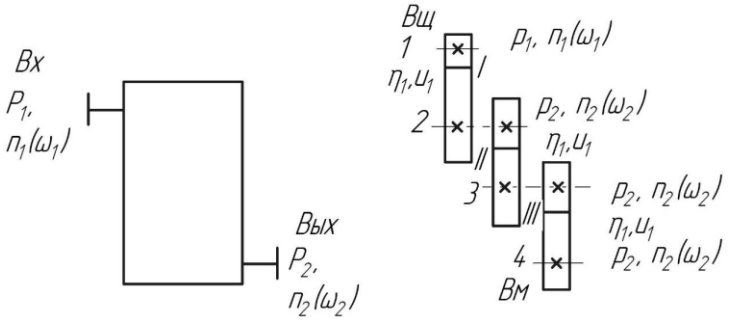
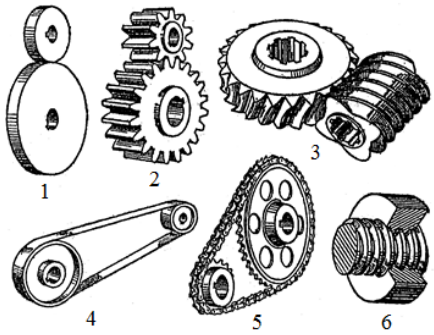


Fig. 1. Transmission scheme with series-connected links



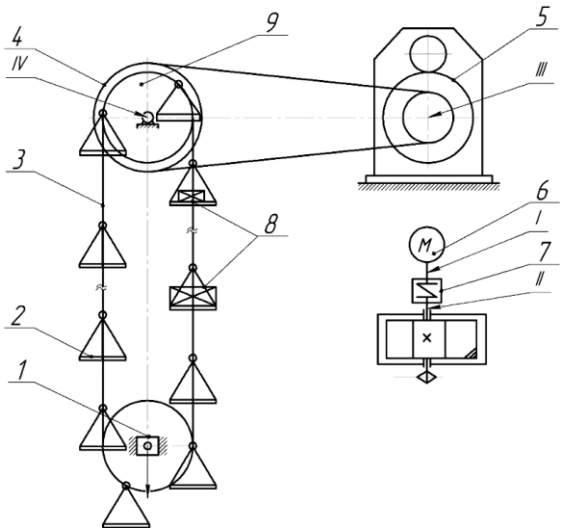
1-friction cylindrical; 2-gear cylindrical; 3-worm; 4-belt; 5-chain; 6-threaded chassis

Fig. 2. Types of gears

The most common are downshifts, since the speed of the actuator in most cases is less than the engine speed. The gear ratio *U* is a special case of the gear ratio *i*. In contrast to *i*, the value *U>1* is always greater than unity, always positive, it refers only to a pair of gears and is used in the calculations.

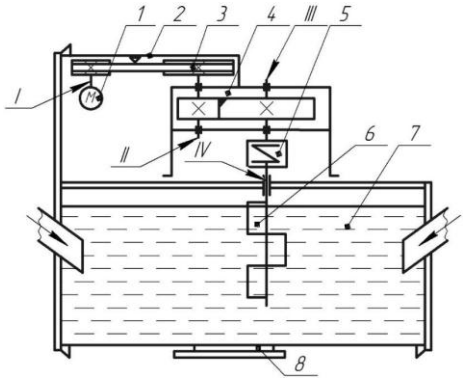
Transmissions are performed with a constant gear ratio and variable (adjustable). Both the former and the latter are widespread (Figure 2). The gear ratio can be adjusted stepwise or steplessly. Step regulation is mainly used in gearboxes with gears, in belt drives with step pulleys, etc. Stepless regulation is carried out using belt or friction variators. The use of one of the methods for adjusting the gear ratio depends on the operating modes of the agricultural machine that the transmission serves (Figures 3-4). Step control of the gear ratio is carried out by simpler and more reliable methods and mechanisms. Stepless regulation contributes to the selection of the optimal production process and increase the quality of work and labor productivity. It provides automation of technological processes along the machine.

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 6, Issue 10 , October 2019



1-tension device; 2-cradle; 3-load chain; 4-chain transmission; 5-cylindrical gearbox; 6-engine; 7-elastic sleeve-sleeve coupling; 8-load; 9-chain load chain I, II, III, IV - shafts, respectively, of the engine, high-speed and low-speed gearbox, working machine

Fig. 3. Drive elevator drive



1-engine; 2-fence; 3 V-belt drive; 4-cylindrical gearbox; 5-elastic coupling with a mountain shell; 6-stirrer; 7-mixture; 8-valve I, II, III, IV - shafts, respectively, of the engine, high-speed and low-speed gearbox, working machine

Fig. 4. Agitator drive

The determination of the gear ratio of a mechanical drive is carried out after selecting an electric motor, determining the power on the drive drive shaft $N_{вш}$ and its angular velocity $\omega_{дв}$ or speed $n_{вш}$ according to the formula

$$U = \frac{n_1}{n_2} = \frac{\omega_1}{\omega_2} \quad (1.3)$$

Then, the gear ratio of the mechanical drive is divided into gear ratios according to the formula

$$U=U_1 \text{ x } U_2 \text{ x}\ldots U_k \quad (1.4)$$

where, U1 is the gear ratio of the first gear stage; U2 - gear ratio of the second gear stage, etc .; k is the number of gears.

When dividing the gear ratio of a mechanical drive into gear ratios, they are usually guided by the data in table 1. [1-2].

Table 1.

Gear ratios for various downshifts

Gear type	Average value	Highest value
Gear transmission gear:		
a) cylindrical wheels		
spur	3–4	12,5
helical	3–5	12,5

ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 6, Issue 10 , October 2019

chevron	4–6	12,5
б) коническимиколесами	2–3	6
Open gear	4–6	20
Worm-gear	8–40	90
Open	15–60	100
Chain drive	3–4	8
Belting		
flat belt		
open	2–4	10
with tension roller	3–5	15
Wedge belt	2–4	10

III. CONCLUSION

The main characteristics of mechanical gears are power N_1 at the entrance and N_2 output W; speed, which is expressed by the speed n_1 at the entrance and n_2 at the exit min^{-1}, s^{-1} or angular speeds ω_1 and ω_2, *glad / s*; $\omega=\pi n/30$; torques on drive and driven shafts T_1 and T_2 (*H m*). These characteristics are minimally necessary and sufficient for the design calculation of any transmission.

REFERENCES

[1]. Artobolevsky I.I. Theory of mechanisms and machines [Text] / II.Artobolevsky. - M.: Nauka, 1975 .-639 p.
[2]. Ivanov M.N. Machine details [Text]: a textbook for engineering specialties of universities / M.N. Ivanov, V.A. Finogenov. - M.: Higher School, 2003 .-- 408 p.