Selected Chapters from Textile and Single-purpose Machines

Drive systems in the construction of single-purpose machines I.

Content

- Drive systems in single-purpose machines
- Unit drives
- Hierarchical structure of driving elements
- Design of drives

Drive systems in single-purpose machines

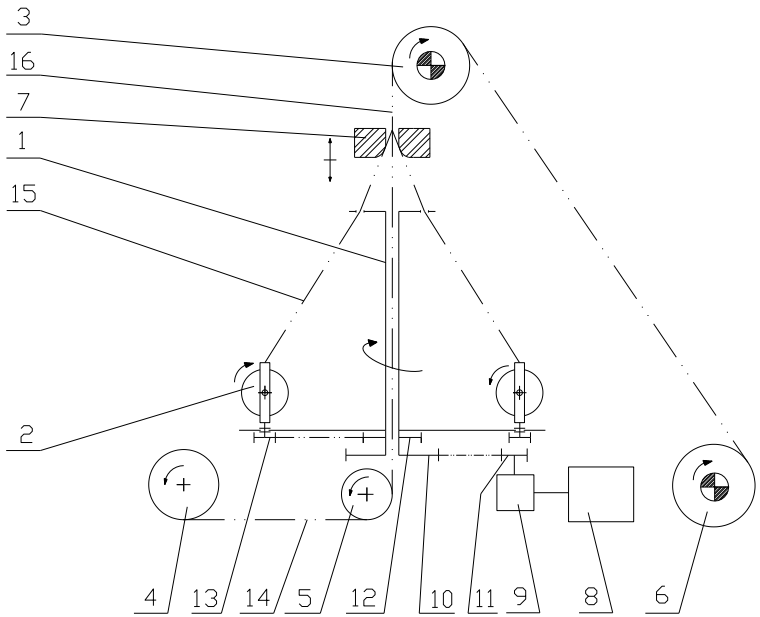
What is the drive function?

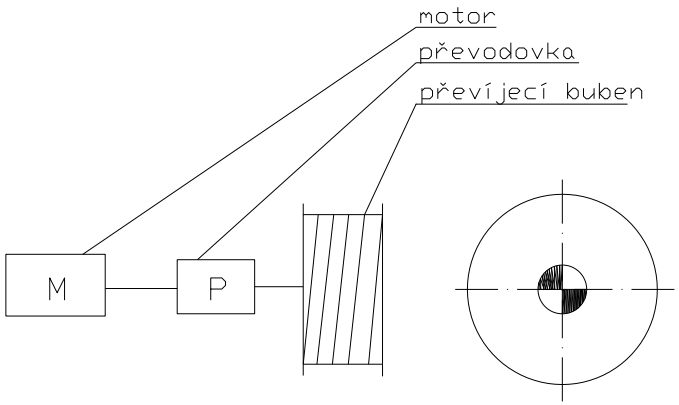
- The function of the drive is the conversion of the input energy into the controlled motion and the subsequent transformation into the controlled motion of the action element (*the motor converts the input primary energy into mechanical*)
- Drive structure block:

- Control: often - program code of the kinematic quantities of the motor in dependence on the required movement of the action element (prescribed stroke)
- Motor Motion Transformation: Direct (without gearbox) / Indirect (with gearbox)

Unit drives VS central drives

In which cases would you use unit drives and what central drive and follow-up transmission to transfer power to action elements?





Types of drives

- Electric
- Fluid
  - pneumatic (medium - air)
  - hydraulic (medium - liquid)
- Combustion
- Mechanical
- Hybrid

Electric drives

Classification by movement

- Rotational
- Linear

Possibilities of electric drives

- Multi-positioning
- force setting
- change speed during movement
- acceleration / deceleration
- a report on the passage through a defined zone
- stop during movement
- increment movement

Electromotors

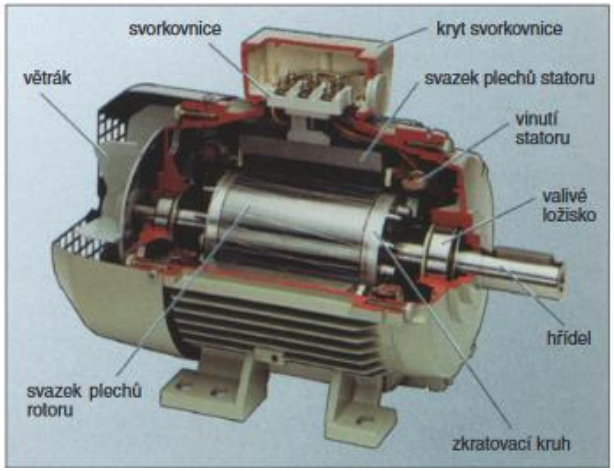
- Servomotors
- DC Motors (DC Motors)
- Asynchronous motors
- Brushless (EC motors)
- Stepper motors

Selected parameters of electric motors

- Rated speed
- Rated torque on the shaft
- Rated power range
- Torque overload coefficient
- Electromechanical constant
- Electrical constant
- Motor voltage (torque) constant

Asynchronous motor - ASM

The three-phase asynchronous motor (ASM) with short-circuit „anchor“ (Fig. 1) is **the most widespread type of electric motor** in the industry.
The advantage of the ASM is its simple design and the resulting high reliability, low maintenance and low cost. It is the most commonly used electric drive with the possibility of **supplying single- or three-phase voltage**.
ASM has a good efficiency
It is a rotating electric AC machine. The energy between the stator and the rotor is transmitted via electromagnetic induction (hence also referred to as an induction motor).
The stator is usually composed of stator sheets, on which the stator winding is made of insulated wires connected mostly to a „star“ or a „triangle“.
The rotor (anchor) has pressed plates with grooves on the shaft, into which are inserted copper bars connected on both sides by brass rings - so called short anchor
The supply voltage can be single-phase or three-phase



Who invented ASM?

Asynchronous motor - principle

- The principle of the operation of an asynchronous motor is to create a rotating magnetic field by passing an alternating current through the stator winding.
- The magnetic field induces voltage in the rotor and the generated current makes a force rotating the rotor.
- The ASM needs a speed slip between the rotor and stator to create current induction in the rotor. The ASM speed slip is load dependent.
- The rotational field speed (and stator) ***n*** is given by the frequency ***f*** of the mains voltage and **the number of poles** of a motor:
- $n = f/p \ [1/s]$
- A so-called slip occurs between synchronous rotational speed of the stator and asynchronous rotor speed. **The ASM rotor can never rotate at the same speed as the stator's magnetic field** (the rotor and stator's magnetic field would have zero slip in this case, no voltage would be induced and no torque would be generated).

Review

- Describe the function and structure of the drive.
- What is the distribution of drives?
- What do you mean by unit drive?
- Draw the speed characteristic of the asynchronous drive.

Thanks for your attention

☺