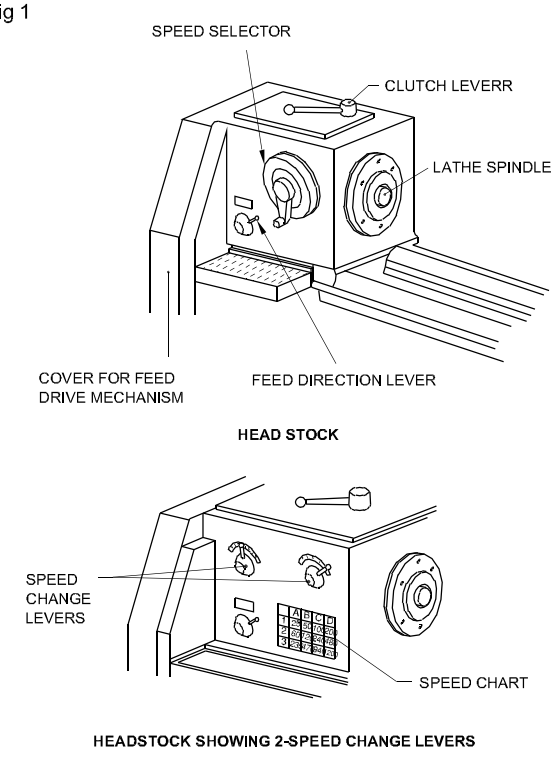
Type of Lathe drive - Merits and de-merits, cone pulley/gear type

Objectives: At the end of this lesson you shall be able to
- **state the functions of the headstock**
- **differentiate between cone pulley headstock and all geared headstock.**

Headstock

It is a fixed unit of lathe on the left hand side. (Fig 1)

Fig 1



HEADSTOCK SHOWING 2-SPEED CHANGE LEVERS

Its main functions are to :

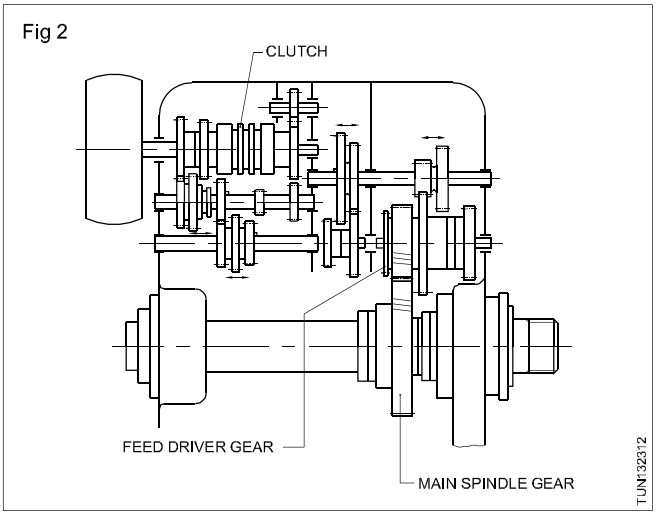
- provide a means to assemble work-holding devices
- transmit the drive from the main motor to the work to make it revolve
- accommodate shafts with fixed and sliding gears for providing a wide range of work speeds
- have shift levers to slide gears to bring in mesh for different speeds
- have a means for lubricating the gears, shafts and bearings.

Constructional features of all-geared headstock (Fig 2)

It is a box-section alloy iron casting having a top cover which can be removed, if needed. It has internal webs for stiffening and taking shaft bearings. It has an input shaft which is connected by means of 'V' belts to the main motor, and runs at constant speed. It is equipped with clutches and a brake.

There may be two or more intermediate shafts on which sliding gears are mounted. The main spindle is the last driven shaft in the headstock assembly. The nose of the spindle is outside the headstock casting and is designed to accommodate the work-holding devices.

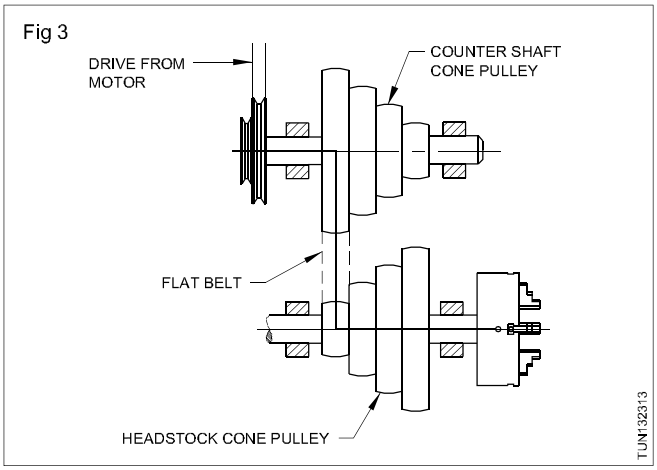
Fig 2



The levers operating the forks of the sliding gears are situated outside in the front of the headstock casting. A sight glass is provided on the top to indicate the functioning of the automatic lubricating system and side of sight glass is provided oil length of the machine.

Cone pulley headstock (Fig 3)

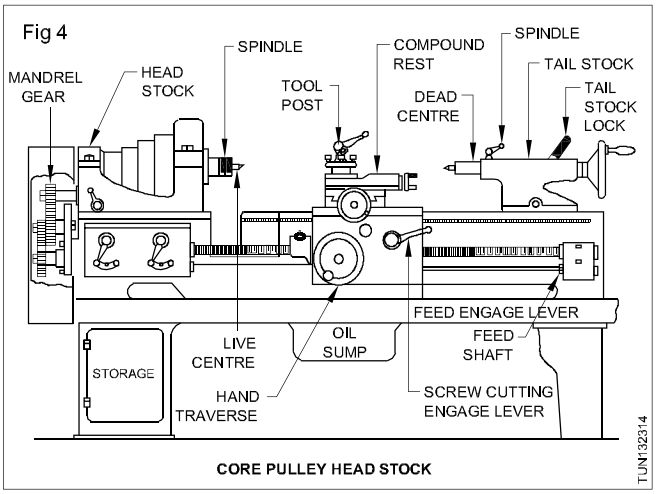
Fig 3



It has a stepped cone pulley mounted on the main spindle and is free to revolve. It is connected by means of a flat belt to a similar cone pulley, the steps arranged in a reversing order. This cone pulley gets the drive from the main motor.

The spindle is mounted on the bush bearings in the headstock casting and a gear wheel called 'bull gear' keyed to it. A pinion is coupled to the cone pulley. The back gear unit has a shaft which carries a gear and a pinion. The number of teeth of the gear and pinion on the back gear

shaft corresponds to the number of teeth on the bull gear and the pinion on the cone pulley. The axis of the back gear shaft is parallel to the axis of the main spindle, and the back gear is brought in engagement or disengagement with the cone pulley system by means of a lever. The back gear unit is engaged to have reduced spindle speeds. (Fig 4)



A three-stepped cone pulley headstock provides three direct ranges of speeds through the belt connection, and with the back gear in engagement, three further ranges of reduced speeds.

Advantages

Easy for maintenance.

Can take up heavy load.

Less noise during functioning.

During overloads, the belt slips off, and hence, no major damage to the lathe is caused.

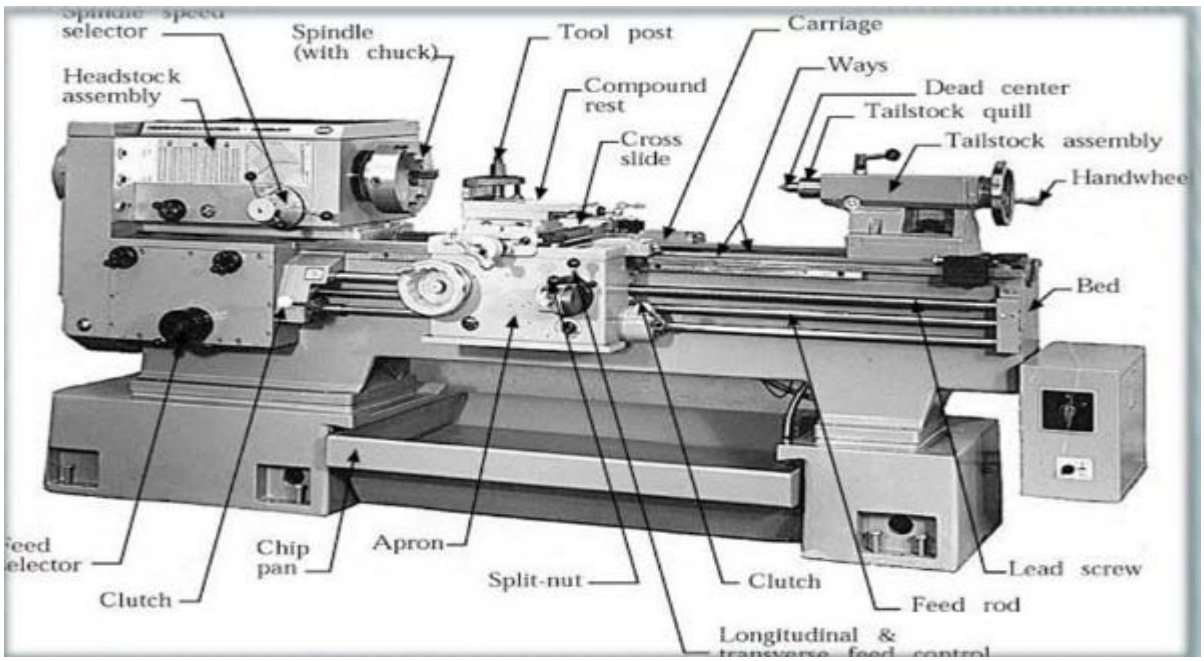
Positive drive when the back gear is in engagement.

Disadvantages

Number of spindle speeds limited to the number of steps in the cone pulley.

Takes time to change spindle speeds.

Needs adjustments of bush bearings.



Back gear unit has a shaft which carries a gear and a pinion. The number of teeth of the gear and pinion on the back gear shaft corresponds to the number of teeth on the pull gear and the pinion on the cone pulley. The axis of the back gear shaft is parallel to the axis of the main spindle, and the back gear is brought in engagement or disengagement with the cone pulley system by means of a ever. The back gear unit is engaged to have reduced spindle speeds. (Fig 6)

If three stepped cone pulley headstock provides three direct ranges of speeds through the belt connection and with the back gear in engagement, three further ranges of reduced speeds.

Advantages

Easy for maintenance.

Can take up heavy load.

Less noise during functioning.

During overloads, the belt slips off, and hence, no major damage to the lathe is caused.

Positive drive when the back gear is in engagement.

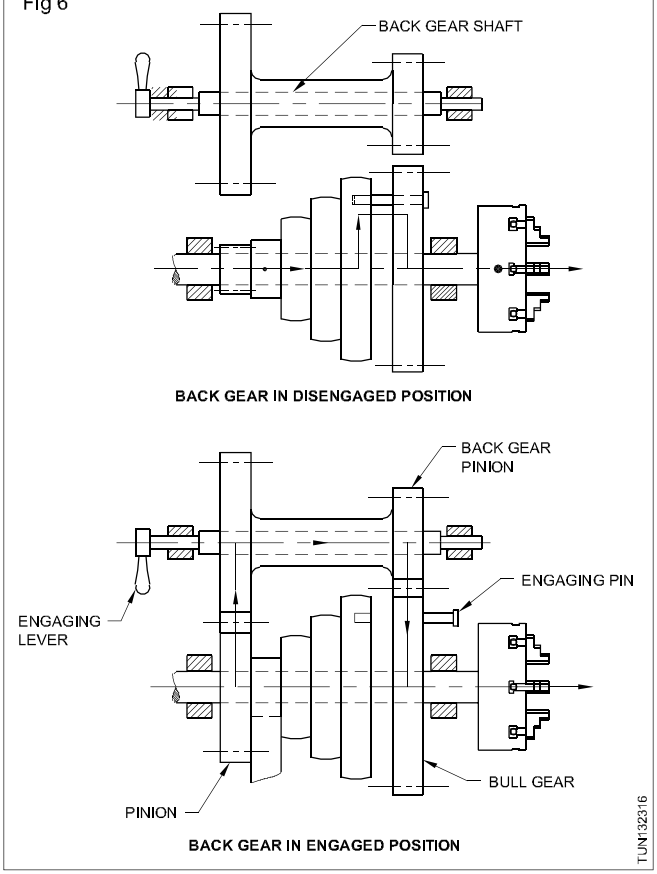
Disadvantages

Number of spindle speeds limited to the number of steps in the cone pulley.

Takes time to change spindle speeds.

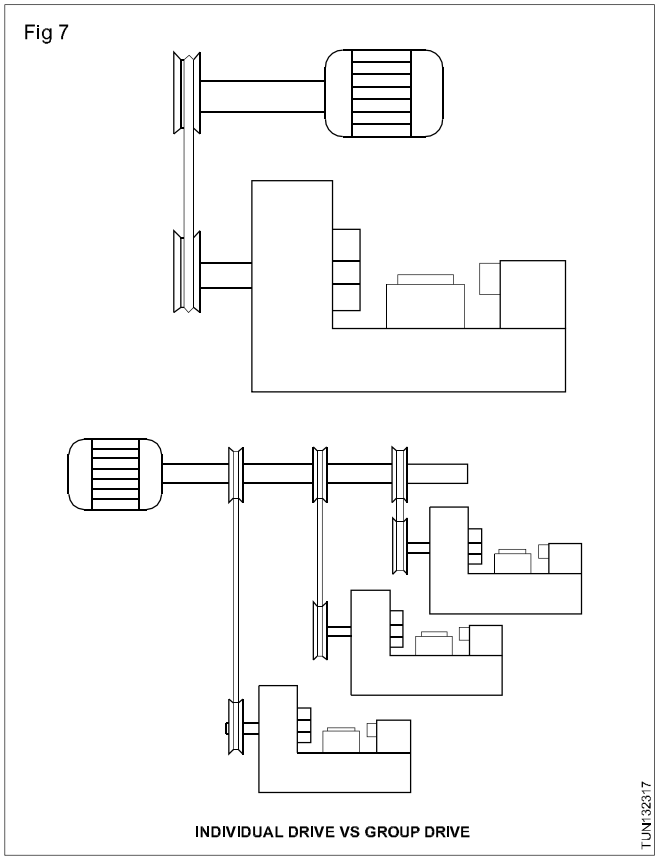
Needs adjustments of bush bearings.

Fig 6



Difference between individual drive vs group drive

Fig 7



Difference between individual drive vs group drive

	Individual drive	**Group drive**
Initial cost	Low	High
Speed	More variation possible	Wider variation possible
Running cost	One	More than one
One time of breakdown	Only one machine get affected	All machine connected to group drive get affected
More likely used	For job production	For mass production
Efficiency	High	Less
Power required	Less	More

Reducing speed, necessity, back gear & use

Objectives: At the end of this lesson you shall be able to
- **state the construction details of back gear assembly**
- **state the function and purpose of back gear.**

Back gear

As its name implies “back gear” is a gear mounted at the back of the head stock. It is used to reduce the speed.

Necessity of back gear

For machining a heavy job, taking a rough cut we need more power at a reduced speed of the spindle. The bach gear arrangement provides this low speed with higher power.

The spindle is mounted on the bush bearings in the headstock casting and a gear wheel called 'bull gear' keyed to it. A pinion is coupled to the cone pulley. The back gear unit has a shaft which carries a gear and a pinion. The number of teeth of the gear and pinion on the back gear shaft corresponds to the number of teeth on the bull gear and the pinion on the cone pulley. The axis of the back gear eccentric shaft is parallel to the axis of the main spindle, and the back gear is brought in engagement or disengagement with the cone pulley system by means of a lever. The back gear unit is engaged to have reduced spindle speeds. (Fig 1)

A three-stepped cone pulley headstock provides three direct ranges of speeds through the belt connection, and with the back gear in engagement, three further ranges of reduced speeds.

Uses of Back gear

- It enables to rotate the chuck at very low speed.
- It provides increased turning power.
- It is highly suitable for turning large diameter castings.
- It reduces the rpm but increases the torque.
- Even the largest face-plate mounted job can be turned successfully.

Fig 1

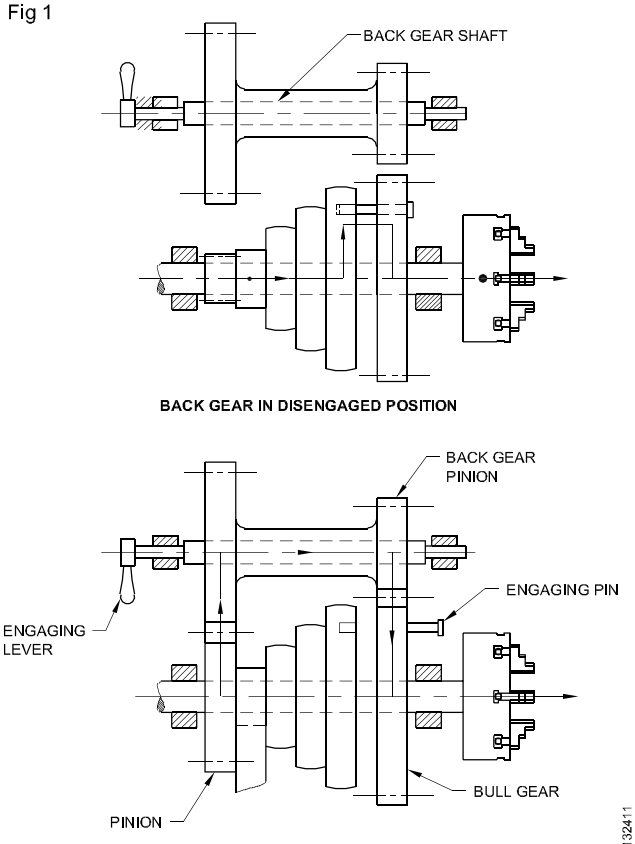
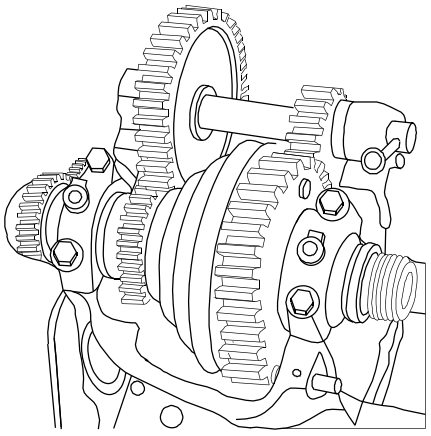


Fig 2



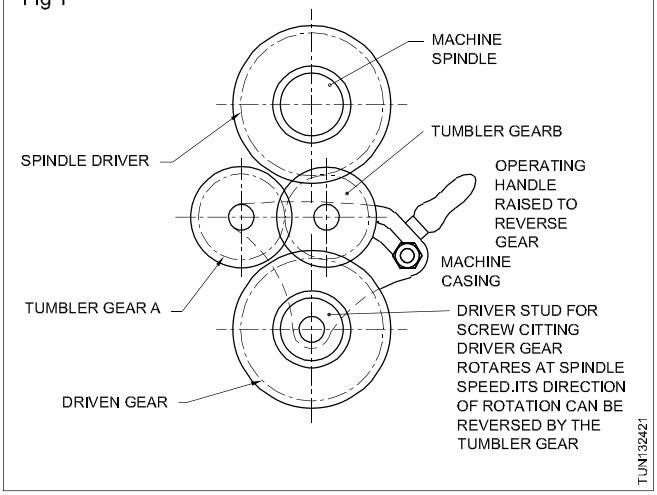
Tumbler gear

Objectives: At the end of this lesson you shall be able to
- **state the purpose of the tumbler gear mechanism**
- **state the construction details of the tumbler gear mechanism.**

Tumbler gear mechanism (Fig 1)

The tumbler gear mechanism is used for changing the direction of rotation of the lead screw and feed shaft. It is normally situated between the spindle drive and the feed gear box. It consists of 3 gears arranged in a simple gear train, mounted on a bracket. The bracket can be shifted into 3 positions.

Fig 1



- For forward rotation of the lead screw and feed shaft.
- For neutral position (no rotation of lead screw and feed shaft).
- For the reverse rotation of the lead screw and feed shaft.

In practice, the first driver gear of a screw cutting train is not fitted directly to the lathe spindle but is mounted on a driver stud which rotates at the same speed as the spindle.

The driving gear on the spindle drives the fixed stud gear, and, since they have the same speed, they must be of the same size. Tumbler gear A is always in mesh with the driven gear and in mesh with the fellow tumbler gear B. In the figure, the drive is direct through the tumbler gear A, and tumbler gear B is idle.

If the tumbler bracket is moved upwards, tumbler gear A rolls around the driven gear until it is out of mesh with the driver gear, and tumbler gear B moves into mesh with the driver, reversing the direction of the driven gear. Thus the two trains available are:

Forward: Driver —>A—>Driven

Reverse: Driver —>B—>A—>Driven.

In yet another position of the tumbler bracket, tumbler gears A or B do not mesh with the driver gear and no drive is transmitted to the driven gear. No feed movement or thread cutting is possible.