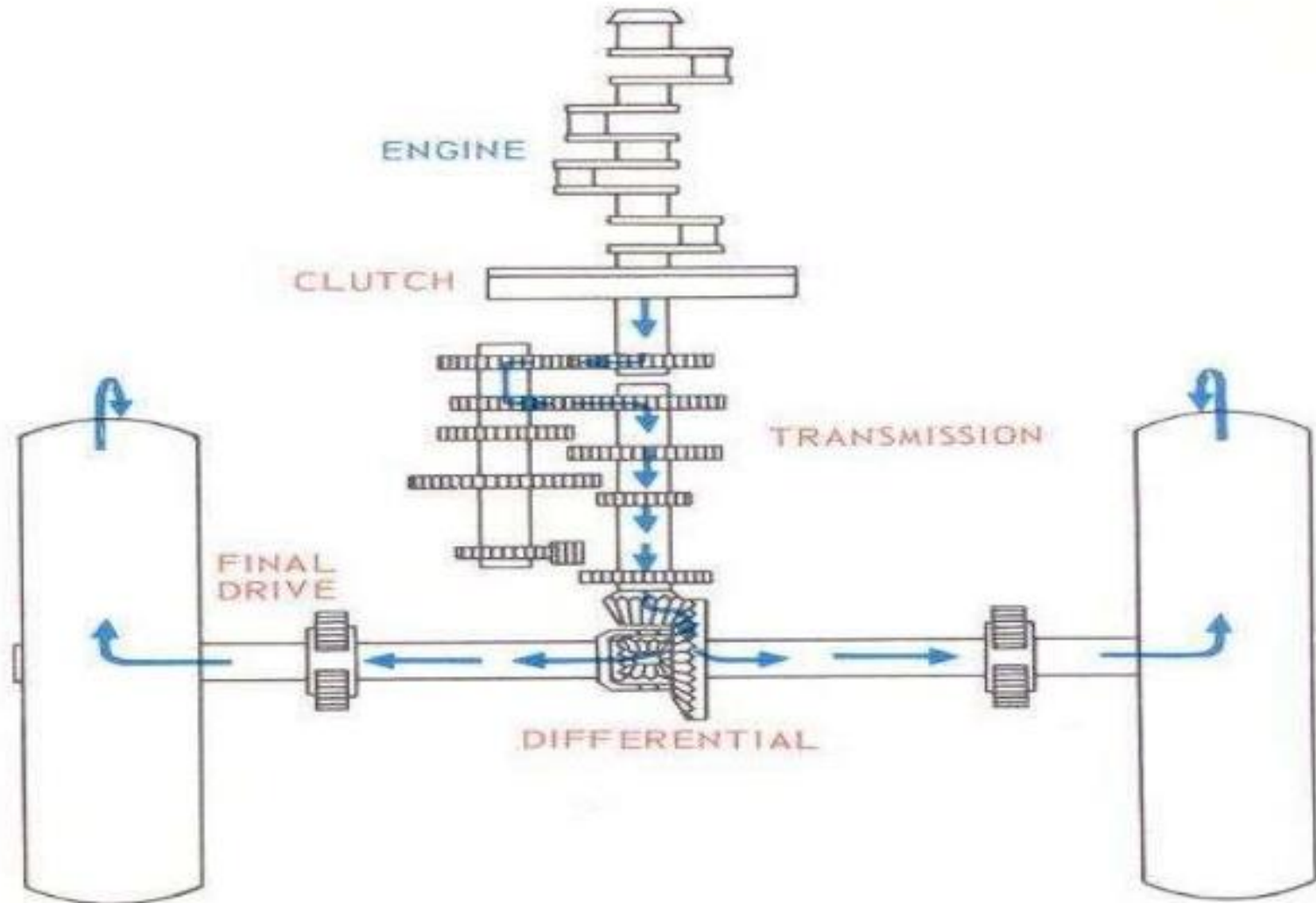
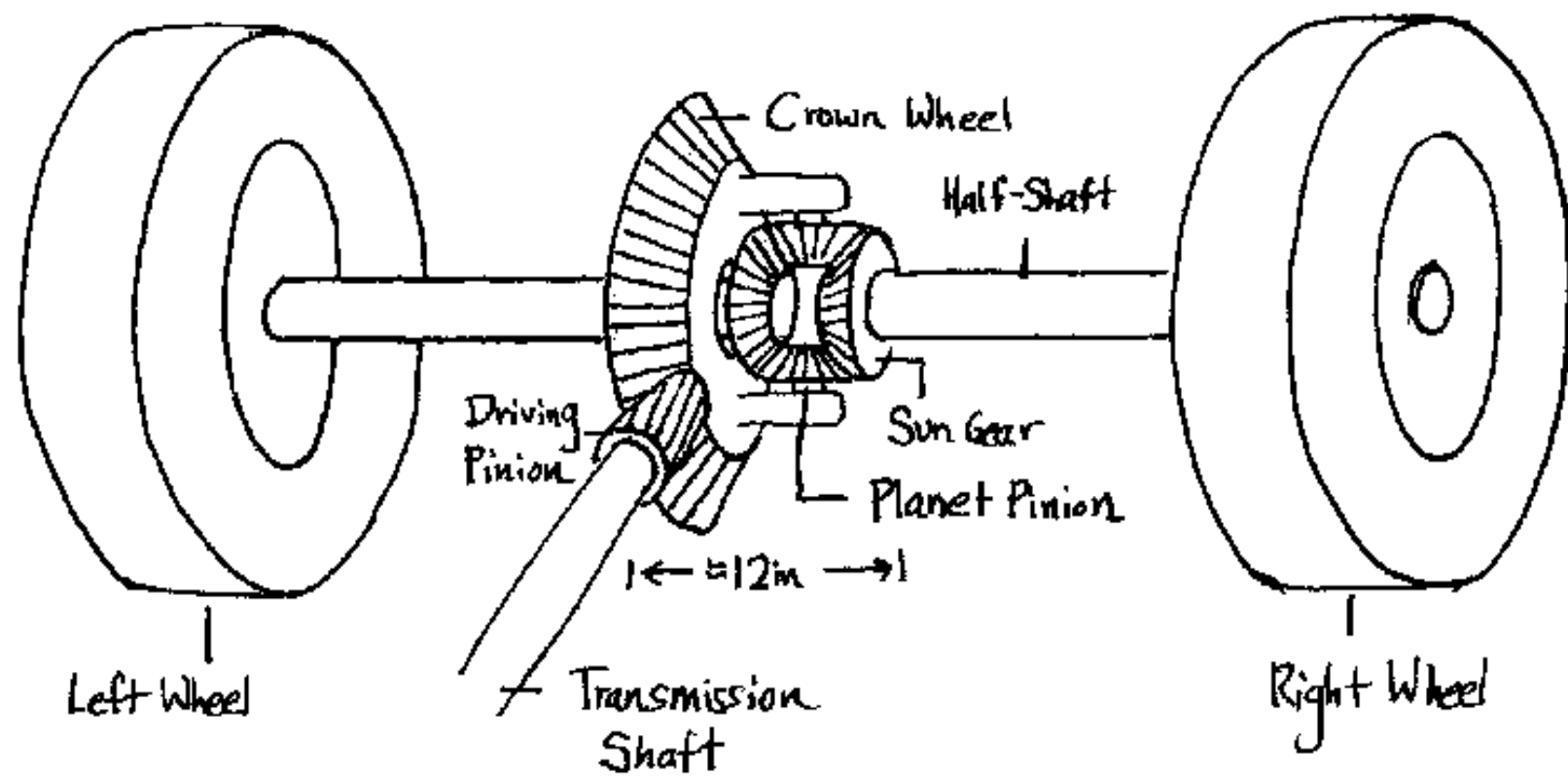


Working principle of differential system and final drive

Power Train of Agricultural Tractors





- *Differential unit* is a special arrangement of gears to permit one of the rear wheels of the tractor to rotate slower or faster than the other.
- While turning the tractor on a curved path, the inner wheel has to travel lesser the tractor to move faster than the other at the turning point.

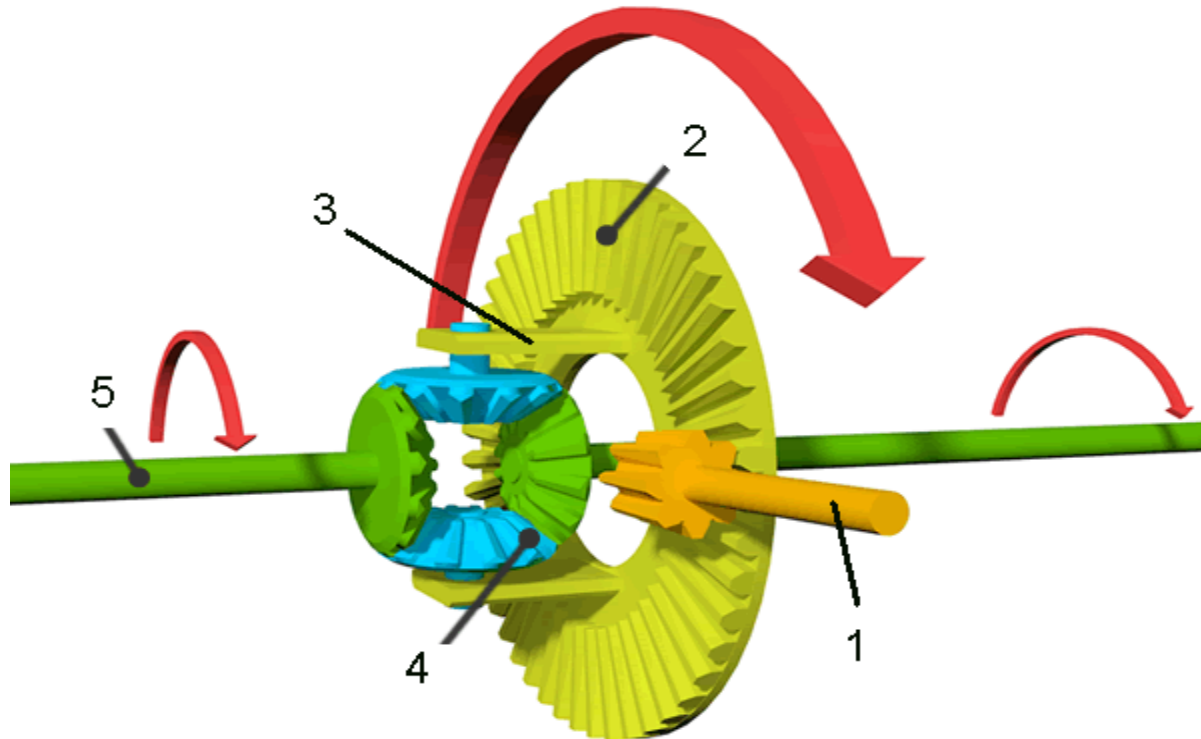
- The output shaft coming from the gear box is provided with a bevel pinion at the end of the shaft.
- The bevel pinion is in mesh with a large bevel wheel known as *crown wheel*.
- *The main functions of crown wheel assembly are:*
 - (i) to transmit power through right angle drive to suit the tractor wheels.
 - (ii) to reduce the speed of rotation.

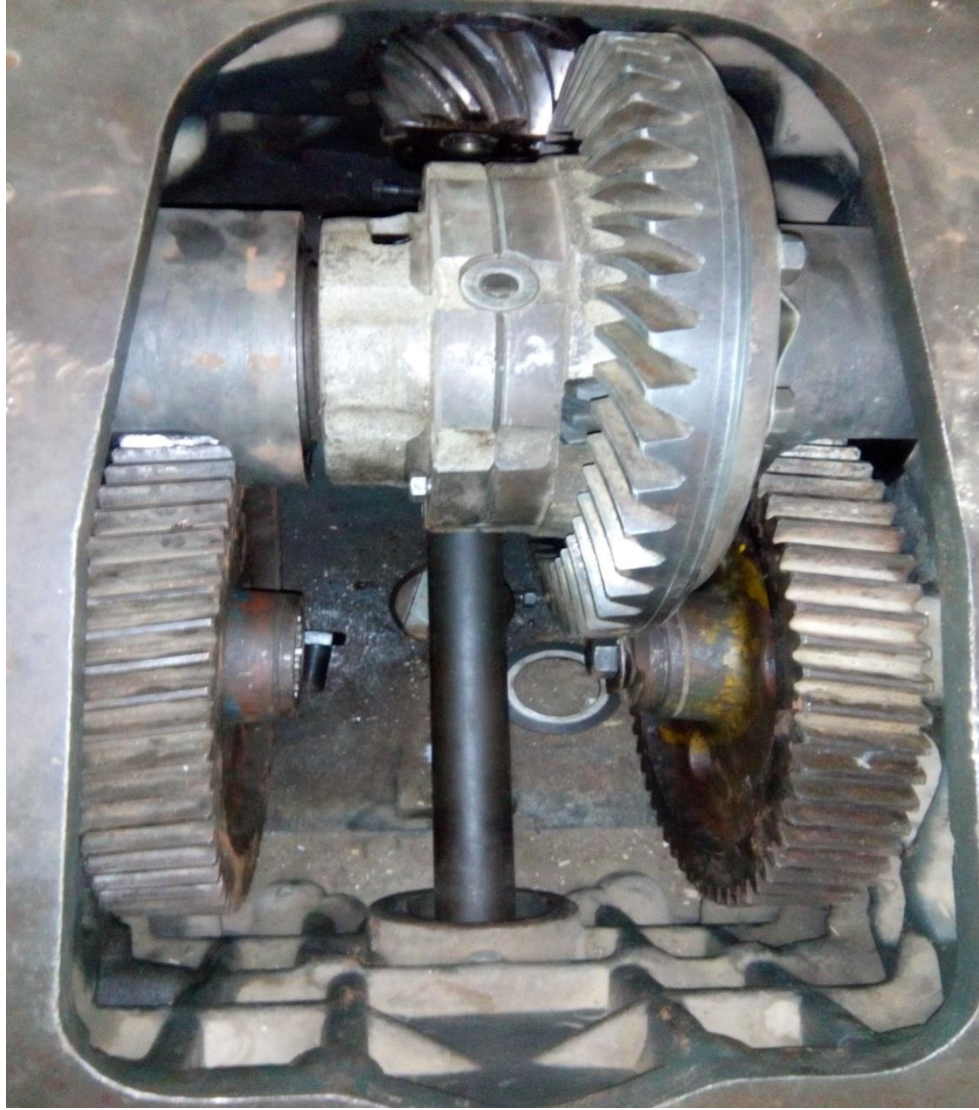
Main Functions Of Differential

- Further reduces the rotations coming from the gear box before the same are passed on to the rear axles.
- Changes the direction of axis of rotation of the power by 90 degree i.e. from being longitudinal to transverse direction.
- To distribute power equally to both the rear driving axles when the tractor is moving in straight ahead direction.
- To distribute the power as per requirement to the driving axles during turning i.e. more rotations are required by the outer wheel as compared to the inner wheel – during turns.

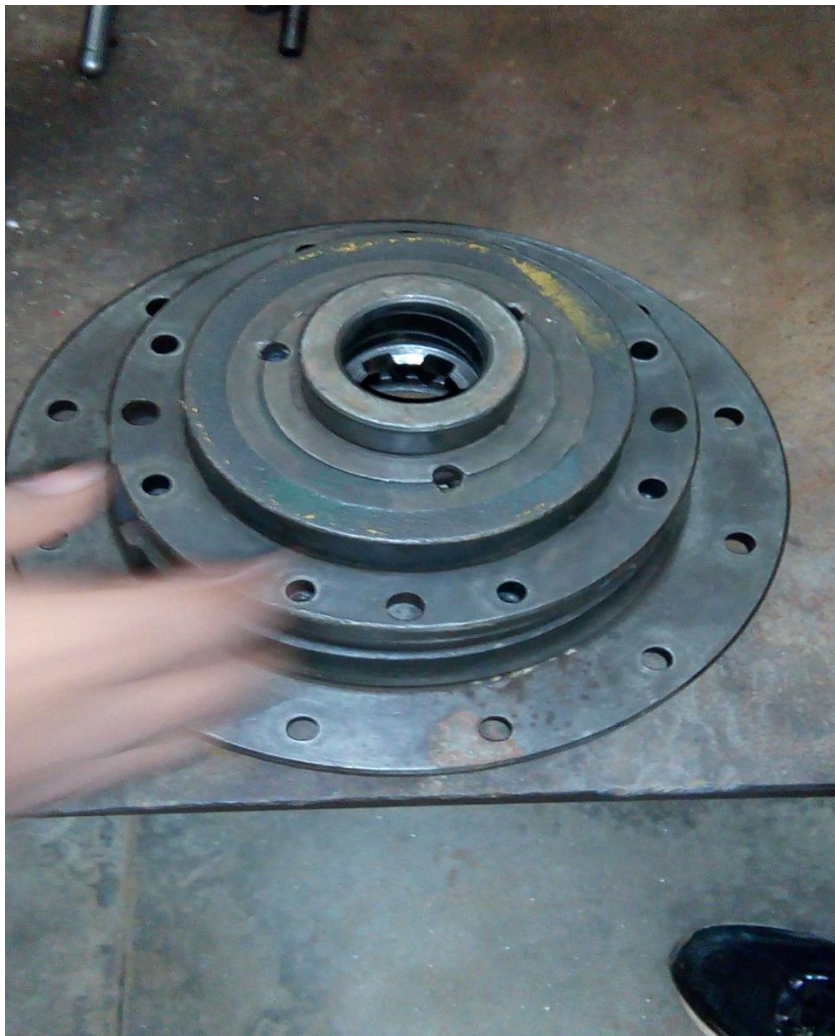
The main components of the differential are:

1. Input pinion gear
2. Crown wheel gear
3. Differential cage
4. Differential star
5. Differential axle (sun) gear











WORKING

- The differential casing is rigidly attached with the crown wheel and moves like one unit.
- Two pinions are provided inside the differential casing, such that they are carried round by the crown wheel but they are free to rotate also on their own shaft or stud.
- There are two or more bevel gears in mesh with differential pinion.

- One bevel pinion is at the end of each half shaft, which goes to the tractor rear wheel.
- Thus instead of crown wheel being keyed directly to a solid shaft between the tractor wheels, the drive is taken back from the indirect route through differential casing, differential pinion and half shaft of the tractor.

- When the tractor is moving in a straight line, the differential pinion do not rotate on the stub shaft but are solid with the differential casing.
- They drive the two bevel gears at the same speed and in the same direction as the casing and the crown wheel.

Differential lock:

- Differential lock is a device to join both half axles of the tractor so that even if one wheel is under less resistance, the tractor comes out from the mud etc as both wheels move with the same speed and apply equal traction.

FINAL DRIVE:

- Final drive is a gear reduction unit in the power trains between the *differential* and the *drive wheels*.
- *Final drive transmits the power finally to the rear axle and the wheels.*
- The tractor rear wheels are not directly attached to the half shafts but the drive is taken through a pair of spur gears.
- Each half shaft terminates in a small gear, which meshes with a large gear called *bull gear*.
- *The bull gear is mounted on the shaft, carrying the tractor rear wheel.*
- The device for final speed reduction, suitable for tractor rear wheels is known as final drive mechanism.





PROBLEM

The speed reductions in the 1st low gear of a tractor gearbox and differential with final drive are 5:1 and 40:1, respectively. For the tractor developing 24 kW power at an engine rpm of 2000 with an overall power transmission efficiency of 80%, the total torque in kN m available at the wheel axle will be

(A) 22.92

(B) 28.64

(C) 16.54

(D) 18.33