

## Lesson 2 cont'd: Power outlets

### 1. Power take-off unit (PTO)

It is a part of tractor transmission system. It is provided with a standard splined shaft at the rear of the tractor to operate the PTO operated machines like mowers, forage harvester, combines etc. The shaft is externally splined to transmit torsional power to another machine as shown in Figure 2.1.



Figure 2.1 Tractor power take - off

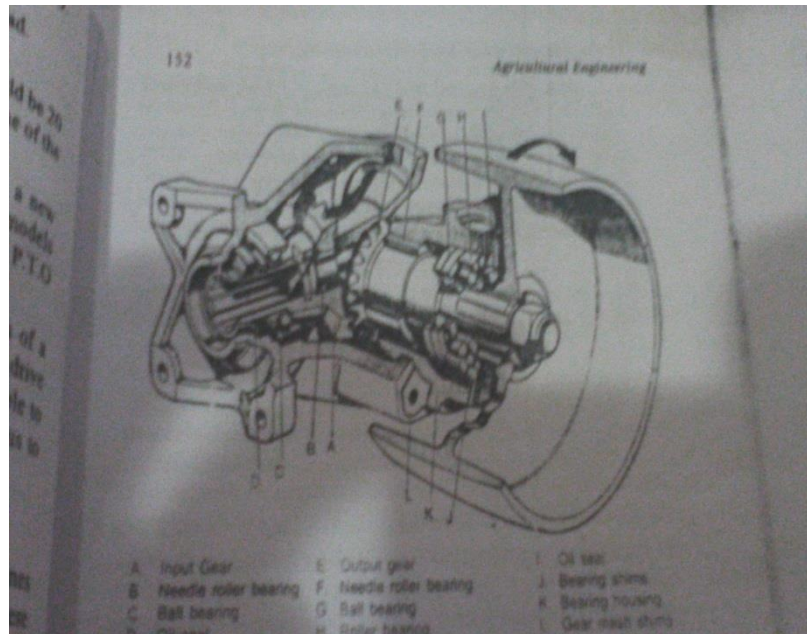
It consists of a shaft, a shield and a cover. A rigid guard fitted on a tractor covers the power take-off shaft as a safety device to avoid accident during operation. This guard is called power take-off shield. On some tractors, the PTO shaft is provided with additional gear unit and a pulley to operate belt driven machines. Agricultural machines are coupled with this shaft at the rear part of the tractor. As per ASABE standard PTO speed is  $540 \pm 10$  rpm when operating under load. In order to operate 1000 rpm drive machine, a new standard has been developed. Modern tractors are provided with PTO speed of  $1000 \pm 10$  rpm.

When a PTO driven machine is connected to the tractor, a telescopic shaft with a universal joint is placed in between as a coupler to take care of the angularity of

the drive. The PTO shaft can be one of the most dangerous parts of a tractor. For human safety, a shield is placed over the rotating drive shaft.

## 2. Belt pulley

A pulley is provided with PTO shaft for some of the tractors through which rotary power output can be tapped for operating stationery machines. The tractor is also used for operating stationary machines like thresher, silage cutter, centrifugal pumps, etc. these machines are driven by a tractor pulley located either on the left, right or rear side of the tractor. When the engine crankshaft is mounted across the tractor chassis, the pulley is placed on the crankshaft itself. When the engine is placed lengthwise, the pulley is driven by set of bevel gears to make the direction of motion of motion of the pulley just parallel to the tractor chassis.



**Figure 2.2:** Tractor pulley

### 3. Hydraulic systems

For lifting implements, tipping and power steering. Hydraulic systems used on tractors and other agricultural machines have made it possible to lower or raise the implements and operate the mechanisms without much efforts.

The hydraulic system of a machine includes hydraulic pumps, oil distributors and regulators, hydraulic cylinders, storage space for fluid, oil pipe lines, safety valves, reducing valves and other special devices.

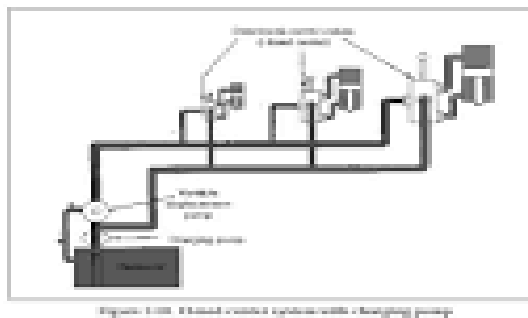


Figure 2.3: Hydraulic system of a tractor

### 4. Tractor Drawbar

Wheels or tracks used on a tractor are primarily meant for converting engine torque to the drawbar pull. Drawbar pull from a tractor is taken by means of its drawbar assembly, which consists of two side members attached to the tractor rear axle housing and a flat crossbar.

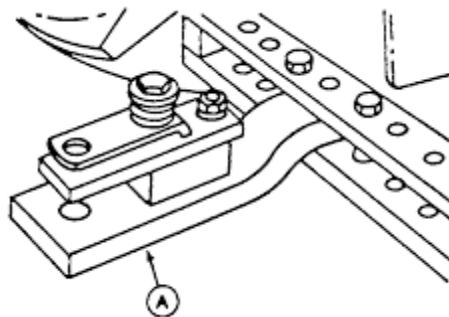


Figure 2.4: Drawbar

Tractors are rated in horsepower capacity as 8-16, 10-20, 15-30, 20-30, etc., the first number representing the drawbar horsepower, and the last number the belt horsepower. The difference of 30% to 50 % between belt horsepower and drawbar horsepower is partly accounted for by;

- (1) The power absorbed in propelling the tractor itself or lost in friction, and
- (2) The use of different factors in calculating the respective horsepower. The belt pulley on most tractors is located on the right -hand side, although in crawler-type tractors it is generally located at the rear. If the engine is set lengthwise in the chassis, the pulley is driven by a bevel gear set at the back of the engine. Gear driven belt pulleys are customarily designed to have a peripheral speed of about 2650 feet per minute. If the engine is set crosswise, the pulley is mounted on one end of the crankshaft, or driven through a spur gear set. With this arrangement the pulley, although smaller, is customarily designed to have a peripheral speed of about 3250 feet per minute, thus requiring a larger pulley on the driven machine to give the same speed  $v = \pi D N$  obtained by a tractor with the lower belt speed . In some tractors the pulley is driven whenever the engine is in operation, while in others there are means for engaging and disengaging the pulley drive either through the main clutch or a special pulley clutch.

## 5. Three point linkage

It is a combination of three links, one is upper link and two are lower links, the links articulated to the tractor and the implements at their ends in order to connect the implement to the tractor. All the tractor drawn implements are attached to this and hydraulic control is also provided for three point linkage. The Three point linkage is shown in Figure 2.5



Figure 2.5: Three point linkage