AGE 222

Introduction to Farm Machinery

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Farm Machinery and Power

- Equipment in the farm are classified as farm power and farm machinery
- Power provides pull/force required tom operate implements… a prime mover only
  - Provide either mobile or stationary operations
- Machinery are tools/implements attached to a power source to manifest the effect of power generated. Without machinery power is useless and without power machinery are not able to perform their intended functions
- Machinery and power are complementary and the combination make up a farm equipment
- Tools….. Without frame and external power source
- Implements …. Several tools mounted on a frame and driven by an external power source

Implement types

- Pulled….trailed
- Mounted
- Semi mounted
- Self-propelled

Operations of farm implements with tractor

•Process of attaching implement to tractor is called Coupling

•Through … the Hitch system or PTO drive system

•Hitch system

•Three point linkage at back of tractor … top link and two lower links

•Corresponding links are established on implement

•Types of hitch system

•One point or single hitch

•Two-point hitch and Three-point system

- Pto drive (Power take off)
- Tractor provides an auxiliary rotary power through a shaft to implements that require a rotary movement.
- A pair of universal joints attached to a long shaft is used … a pto drive
- Two standard drives for farm implements..
  – 1000rpm and 540 rpm

Power Transmission

- Power from tractors to implements are transmitted to various components called machine elements
- Transmissions elements are used in determining power transmission system of any machine or equipment
- Power transmission methods
  - Belt and pulley drive
  - Shaft and universal joint drive (pto)
  - Sprocket wheel and chain drive
  - Gear drive
  - Hydraulic system

Pulley and belt drives

- Simplest form of transmission, made up of a belt that forms a band around a set of pulley or sheave
- Belt … a flexible material made from natural or artificial rubber, canvas or leather.
  - Flat or vee shaped belt
  - Flat belt…… rectangular, endless by metal fasteners
  - Vee-shaped belt … trapezoidal, reduces slippage, standard sized.
  - Positive drive belt… precision or timing belt … mesh into splines
- Pulley are cylindrical elements in form of wheels on which belt runs. Used on flat belt
  - Crowning prevents slippage
- Sheaves are made of cast iron with grooves embedded along its circumference to accept the shape of a vee - belt
  - Used for vee -belts
- Arrangements
  - Opened or closed (Cross)
- Belt speed ratio
- Belt length
- Driven power
- Belt maintenance

Shaft and universal joint (pto drive)

- A shaft . Hollow or solid bar on which revolving elements are mounted, subjected to all types of loading
- Axle is a solid or hollow bar carrying revolving elements but not subjected to torsion loading
- A spindle is a short rotating shaft
- Shapes are dependent on uses and design but mostly cylindrical

Universal joints

- Used with a shaft to provide efficient power transmission at bends or corners
- Commonly used are Cardan or Hooke joint
- Pto drives are used on mounted or trailed implements such as harvester, sprayer, rotary or vibratory implements where constant angular speed are required

Sprocket Wheel and Chain drive

- Chain drive consist of endless chain whose links are designed to engage the tooth of a heeled sprocket
- Chain
- Sprocket
- Lubrication is essential
- Avoid excessive tension
- No creep
- Distance not restricted

Gear Drives

- Gear is a solid cylindrical element with set of tooth around its circumference
- Gear drive consist of two or more gears that engage each other with the aim of transmitting motion without shock ,minimum wear and noise.
- Gear drive is one of the most commonly used trans.. system
- Arrangement
  - Simple or Compound
- Types
  - Spur, helical, Bevel, worm
- Characteristics
  - Transmits more efficiently
  - Low power loss
  - Higher cost
  - Speed is inversely proportional to number of tooth on gear
  - Speed Ratio in Toothed Gear
    - Speed ratio for simple arrangement
    - Speed ratio for compound arrangement

Other Elements

- Bearings
  - Radial and thrust
  - Plain or journal and Rolling contact

  Lubrication necessary

  effects of lubrication

  reduces friction, acts as coolant, flushes out dirt, prevents corrosion.
- Spring
  - Designed to Provide large elastic deflection under loading

Hydraulic system

- Method of transmitting motion through a fluid medium from a power source to a machine or component
- Allows transmission to a remote or inaccessible sections of a machine
- Makes it easier to convert rotary motion to other forms of motion
- Basic components are pump, actuator, connector, valves, sump, fluid, filters, lines, couplers.

Hydraulic components

- Pump … creates the flow of the fluid medium
- Converts power from the engine to fluid power
- Motor … converts fluid power into a rotary motion where required, usually in a far place from power source.
- Actuators: devices that manifest the effect of the pump in the hydraulic system
- They are usually hydraulic cylinders and hydraulic motors
- Valves …. To control actions performed by actuators
- Three groups … Directional (Spool or Check)
- Pressure Valves (Pressure control, pressure relief, by-pass, priority or pressure sequence valve, reducing valve)
- Volume control valve

- Lines and Couplers
- Lines are flexible tubing or hoses made of steel , copper or synthetic rubber. Have inner and outer cores resistant to oil.
- Inner core reinforced with steel/ layers of wire, or fabric braid to avoid failure
- Strength of hose inversely proportional to diameter

Components Cont'd

- Couplers are used in joining hoses or connect hoses as part of a main system or to a secondary system.
- Hydraulic fluid
- Moving component of the system that transmit power at high pressure
- Also lubricate the system
- Viscosity is ability to resist flow
- Adequate viscosity to prevent leakages and reduced efficiency

- Reservoir or Sump
- Storage for the moving fluid
- Incorporates cooler to remove heat generated by fluid during movement in circuit

Tractor Implement Control Systems

- Nudging
- Implements control by hand lever at side of operator by pushing forward and back to neutral position for lifting and keeping in position.
- Auto-position
- Allows selection of predetermined position of implement by positioning the hand lever control. The position is maintained for the implement during operation regardless of leakages or obstructions

- Auto-Draft
- Allows a selection of pre-determined draft or force required by an implement by a position on the lever control. A sensing device usually attached to the link system maintains the draft regardless of obstruction by varying the depth of penetration if used in tillage practices