

FARM TRACTOR

Tractor is a self-propelled power unit having wheels or tracks for operating agricultural implements and machines including trailers. Tractor engine is used as a prime mover for active tools and stationary farm machinery through power take-off shaft (PTO) or belt pulley.

CLASSIFICATION OF TRACTORS

Tractors can be classified into three classes on the basis of structural-design:

- (i) **Wheel tractor:** Tractors, having three or four pneumatic wheels are called *wheel tractors*. Four-wheel tractors are most popular everywhere.
- (ii) **Crawler tractor:** This is also called *track type tractor* or *chain type tractor*. In such tractors, there is endless chain or track in place of pneumatic wheels.
- (iii) **Walking tractor (Power tiller):** Power tiller is a walking type tractor. This tractor is usually fitted with two wheels only. The direction of travel and its controls for field operation is performed by the operator, walking behind the tractor.

On the basis of purpose, wheeled tractor is classified into three groups:

- (a) **General purpose tractor:** It is used for major farm operations; such as ploughing, harrowing, sowing, harvesting and transporting work. Such tractors have (i) low ground clearance (ii) increased engine power (iii) good adhesion and (iv) wide tyres.
- (b) **Row crop tractor:** It is used for crop cultivation. Such tractor is provided with replaceable driving wheels of different tread widths. It has high ground clearance to save damage of crops. Wide wheel track can be adjusted to suit inter row distance.
- (c) **Special purpose tractor:** It is used for definite jobs like cotton fields, marshy land, hillsides, garden etc. Special designs are there for special purpose tractor.

TRACTOR COMPONENTS

A tractor is made of following main components:

- (1) I. C. engine, (2) Clutch (3) Transmission gears (4) Differential unit (5) Final drive (6) Rear wheels (7) Front wheels (8) Steering mechanism (9) Hydraulic control and hitch system (10) Brakes (11) Power take-off unit (12) Tractor pulley and (13) Control panel.

Every tractor is fitted with an I. C. engine, the engine may be carburettor type or diesel type but nowadays almost all the tractors are diesel tractors.

SELECTION OF TRACTOR

Selection of tractor depends upon following factors:

- (1) **Land holding:** Under a single cropping pattern, it is normally recommended to consider 1 hp for every 1 hectares of land, In other words, one tractor of 20-25 hp is suitable for 20 hectares farm.
- (2) **Cropping pattern:** Generally less than 1.0 hectare/hp have been recommended where adequate irrigation facilities are available and more than one crop is taken. So a 30-35 hp tractor is suitable for 25 hectares farm.
- (3) **Soil condition:** A tractor with less wheel base, higher ground clearance and low overall weight may work successfully in lighter soil but it will not be able to give sufficient depth in black cotton soil.
- (4) **Climatic condition:** For very hot zone and desert area, air cooled engines are preferred over water-cooled engines. Similarly for higher altitude, air cooled engines are preferred because water is liable to be frozen at higher altitude.
- (5) **Repairing facilities:** It should be ensured that the tractor to be purchased has a dealer at near by place with all the technical skills for repair and maintenance of machine.
- (6) **Running cost:** Tractors with less specific fuel consumption should be preferred over others so that running cost may be less.
- (7) **Initial cost and resale value:** While keeping the resale value in mind, the initial cost should not

be very high; otherwise higher amount of interest will have to be paid.

(8) Test report: Test report of tractors released from farm machinery testing stations should be consulted for guidance.

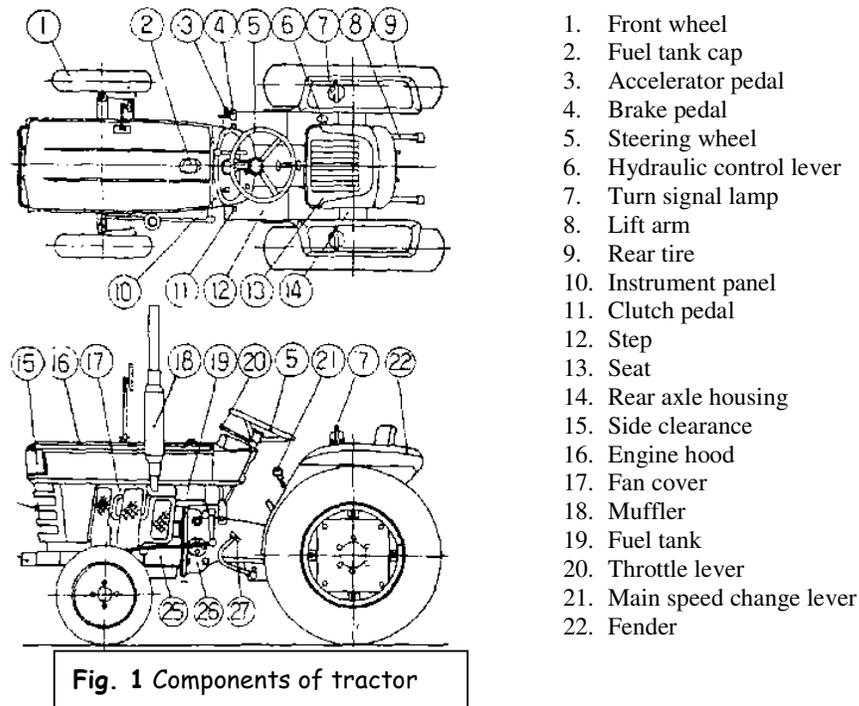


Fig. 1 Components of tractor

CONTROL BOARD OR DASH BOARD OF A TRACTOR

The control board of a tractor generally consists of:

(1) Main switch (2) Throttle lever (3) Decompression lever (4) Hour meter (5) Light switch (6) Horn button (7) Battery charging indicator (8) Oil pressure indicator and (9) Water temperature gauge.

TRACTOR TYRES AND FRONT AXLE

TYRES: The tyres are available in many sizes with the ply ratings as 4, 6 or 8. The ply rating of tyres indicates the comparative strength of tyres. The higher the rating, the stronger are the tyres. The tyres size 12—38 means, that the sectional diameter of tyres is 12" and it is mounted on a rim of 38" diameter. The inflation pressure in the rear wheels of the tractor varies between 0.8 to 1.5 kg/cm². The inflation pressure of the front wheel varies from 1.5to2.5kg/ cm². Useful life of the pneumatic tyres under normal operating condition may be about 6000 working hours for drawbar work.

FRONT AXLE: Front axle is the unit on which front wheel is mounted. This wheel is an idler wheel by which tractor is steered in various directions. The axle is a rigid tubular or I-section steel construction pivoted at the centre. There are various adjustments of front wheel.

Hitching system of Tractor Drawn Implements

Tractor drawn implements possess higher working capacity and are operated at higher speeds. These implements need more technical knowledge for operations and maintenance work. Tractor drawn implements may be a) Trailed type b) Semi-mounted type and c) Mounted type.

a) **Trailed type implement:** It is one that is pulled and guided from single hitch point but its weight is not supported by the tractor.

b) **Semi-mounted type implement:** This type of implement is one which is attached to the tractor along a hinge axis and not at a single hitch point. It is controlled directly by tractor steering unit but its weight is partly supported by the tractor.

c) **Mounted type implement:** A mounted implement is one which is attached to the tractor, such that it can be controlled directly by the tractor steering unit. The implement is carried fully by the tractor when out of work.

SOME IMPORTANT TERMS CONNECTED WITH TRACTORS

Wheelbase: Wheel base is the horizontal distance between the front and rear wheels of a tractor, measured at the ground contact.

Ground clearance: It is the height of the lowest point of the tractor from the ground surface, the tractor being loaded to its maximum permissible weight.

Track: Track is the distance between the two wheels of the tractor on the same axle, measured at the point of ground contact.

Turning space: It is the diameter of the smallest circle, described by the outermost point of the tractor, while moving at a speed, not exceeding 2 km/hr with the steering wheels in full lock.

Cage wheel: It is a wheel or an attachment to a wheel with spaced cross bars for improving the traction of the tractor in a wet field. It is generally used in paddy fields.

POWER TILLER

It is a prime mover in which the direction of travel and its control for field operation is performed by the operator walking behind it. It is also known as *hand tractor* or *walking type tractor*. The concept of power tiller came in the world in the year 1920. Japan is the first country to use power tiller on large scale. In Japan, the first successful model of power tiller was designed in the year 1947. Production of power tiller rapidly increased during the year 1950 to 1965. Power tiller was first introduced in India in the year 1963.

Power tiller is a walking type tractor. The operator walks behind the power tiller, holding the two handles of power tiller in his own hands. Power tiller may be called a single axle walking type tractor, though a riding seat is provided in certain designs. Average size of holding in India is about 2.5



Power tiller

hectares. There are 89% of total land holdings of less than six hectares. Under such conditions, power tiller may be useful as a power unit.

Components of power tiller: A power tiller consists of the following main parts:

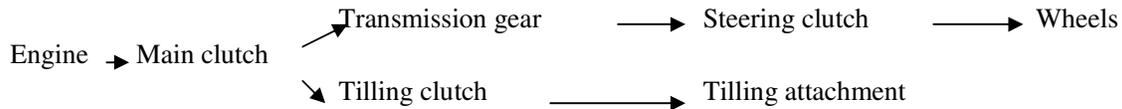
(1) Engine (2) Transmission gears (3) Clutch (4) Brakes (5) Rotary unit.

All the power tillers are fitted with an I. C. engine. At present, most of the power tillers are fitted with diesel engine. The makes like Kubota, Mitsubishi, and Sarachi have used diesel engine in India.

Operation: The main clutch is a lever on the handle. The lever can be shifted to *on* or *off* position while operating in the field. When the lever is shifted to *on* position, the power from the engine is transmitted through the main clutch to the various parts of the power tiller. When the lever is shifted to *off* position the power from the engine is cut-off from the rest of the transmission.

Power transmission in power tiller: For operation of power tiller, the power is obtained from the IC Engine, fitted on the power tiller. The engine power goes to the main clutch with the help of belt or chain. From main clutch, the power is divided in two routes, one goes to transmission gears, steering clutch and then to the wheel. The other component goes to the tilling clutch and then to the tilling attachment.

The flow diagram for transmission of power is given below:



V-belt is usually used to transmit power from the engine to the main clutch, because V-belt has very high efficiency and it works as a shock absorber also.

Main clutch: Power goes from the engine to the main clutch. Clutch may be: (i) Friction clutch or (ii) V-belt tension clutch.

Friction clutch is generally used for bigger power tiller. Usually it is a dry type multiple disc clutch. V-belt tension clutch is used for small power tillers. The main functions of clutch in a power tiller are:

- (i) to transmit engine power to transmission gears and
- (ii) to make power transmission gradual and smooth.

Transmission gears: Transmission box consists of gears, shafts and bearings. The speed change device may be; (a) gear type or (b) belt type.

Brakes: All power tillers have some braking arrangement for stopping the movement. Most of the power tillers use *inner side expansion type* brake.

Wheels: Usually 2 to 4 ply pneumatic tyres are used in power tillers. The pressure of the tyre ranges from 1.1 to 1.4 kg/cm².

Rotary unit: Power tiller has a rotary unit for field operation.

Rotary unit is of two types: (a) Centre drive type and (b) Side drive type.

Centre drive type has got transmission at the centre and the side drive type has transmission at one side. *Centre drive* type has the following characteristics: (a) Tilling width can be widened (b) Rotary unit is light in weight (c) Fixing of attachment is easy (d) The tine shaft can be detached easily (e) Mounting and dismounting of rotary unit is very easy (f) It may leave some portion of the field untilled (g) It has one point support on the ground.

In side drive type :- (i) Deeper tilling is possible (ii) The arrangement is useful for hard soil (iii) It has two points support on the ground.

Rotary tines: Rotary tines are used in rotary unit for soil cutting and pulverisation purpose. Rotary tines are of three types:

- (i) Straight tines (ii) Curved tines and (iii) Sliding tines.

In case of **straight tines** : (a) Power consumption is less (b) Fine pulverisation of soil is possible (c) Poor soil turning (d) Grass entangles in the tines very easily (e) It is suitable for hard soil.

In case of **curved tines**: (a) Good soil turning is possible (b) It is suitable for avoiding grasses (c) Pulverisation of soil is coarse and (d) Power consumption is high.

Sliding tines have the characteristics of sliding on their positions according to the requirement.

Steering clutch lever: Steering clutch is provided on the grip of the right and left handles. When the left side is gripped, power is cut-off on left side of the wheel and the power tiller turns to the left. Similarly when the right side is gripped, the power tiller turns to the right.