



Classification of Engineering Materials

The engineering materials are mainly classified as :

(a) Ferrous metals, and (b) Non-ferrous metals.

a) **Ferrous Metals:-** The *ferrous metals are those which have the iron as their main constituent, such as cast iron, wrought iron and steel.

i. **Cast Iron:-** The cast iron is obtained by re-melting pig iron with coke and limestone in a furnace known as cupola. It is primarily an alloy of iron and carbon. The carbon contents in cast iron varies from 1.7 per cent to 4.5 per cent. It also contains small amounts of silicon, manganese, phosphorous and sulphur.

ii. **Wrought Iron:-** It is the purest iron which contains at least 99.5% iron but may contain up to 99.9% iron. The wrought iron is a tough, malleable and ductile material.



iii. Steel:- It is an alloy of iron and carbon, with carbon content up to a maximum of 1.5%. The carbon occurs in the form of iron carbide, because of its ability to increase the hardness and strength of the steel.

(b) Non- Ferrous Metal:- The non-ferrous metals are those which have a metal other than iron as their main constituent, such as copper, aluminum, brass, tin, zinc, etc.

i. Aluminum:- It is white metal produced by electrical processes from its oxide (alumina), which is prepared from a clayey mineral called bauxite. It is a light metal having specific gravity 2.7 and melting point 658°C. The tensile strength of the metal varies from 90 MPa to 150 MPa.

ii. Copper:- It is one of the most widely used non-ferrous metals in industry. It is a soft, malleable and ductile material with a reddish-brown appearance. Its specific gravity is 8.9 and melting point is 1083°C. The tensile strength varies from 150 MPa to 400 MPa under different conditions. It is a good conductor of electricity.

iii. Copper-zinc alloys (Brass):- The most widely used copper-zinc alloy is brass. There are various types of brasses, depending upon the proportions of copper and zinc. This is fundamentally a binary alloy of copper with zinc each 50%.



TILLAGE IMPLEMENT

MATERIAL OF CONSTRUCTIONS

Mould board plough:-

-Frame

Mild steel

-Mould board

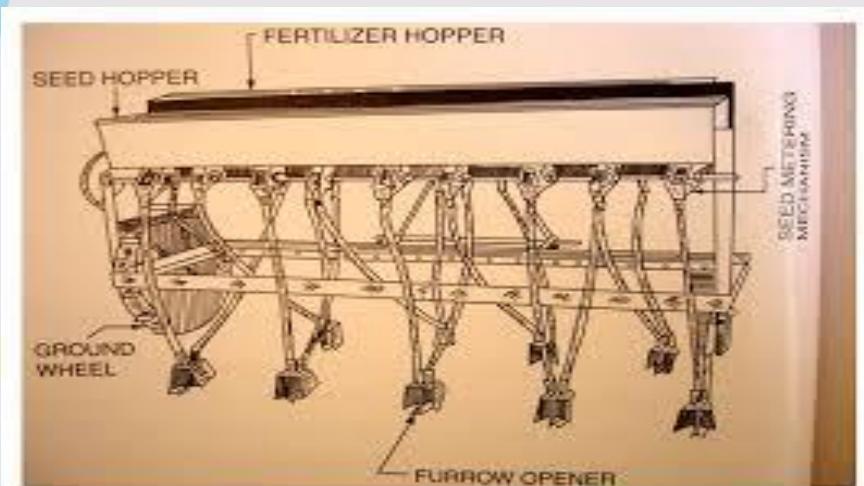
Soft centred steel/ high carbon steel/ chilled cast iron.

-Share

Mild steel/ high carbon steel.



SOWING IMPLEMENT	MATERIALS OF CONSTRUCTION
Seed drill:-	
-Hopper	Mild steel / galvanized steel/ fibre glass
-Seed tube	Plastic/ rubber/ PVC plastic
-Fluted rolls	Plastic/ aluminium/ cast iron
-Gear or chain	Mild steel/ cast iron
-Boot	High carbon steel
-Furrow opener	High carbon steel
-Frame	Mild steel



THRESHING EQUIPMENT

MATERIAL OF CONSTRUCTION

-Wire loop thresher gear

Medium carbon steel

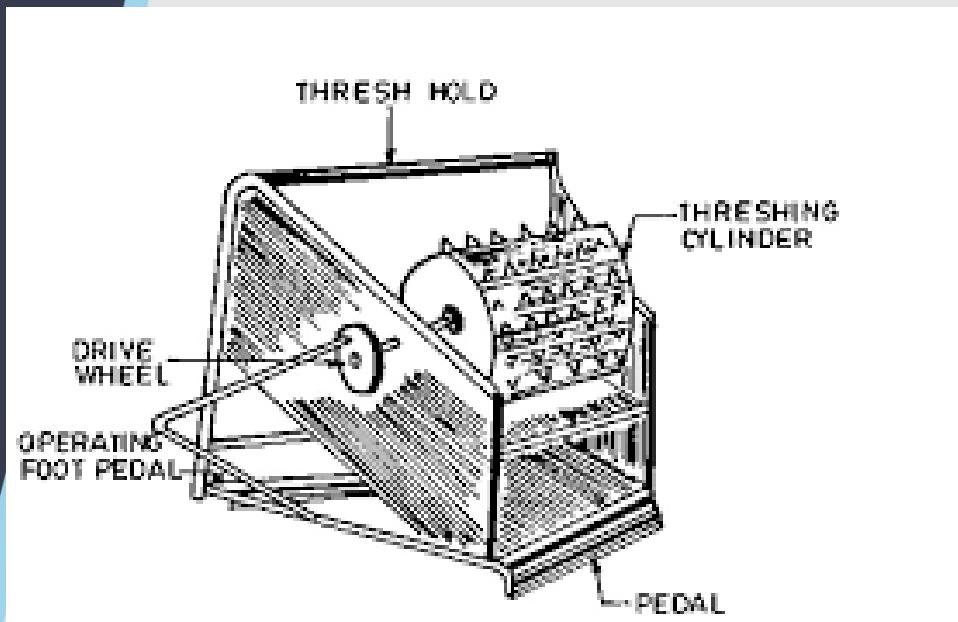
-Cover or frame

Mild steel

-Hook or wire loop

Mild steel wire or spring steel wire.

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HARVESTING EQUIPMENT	MATERIAL OF CONSTRUCTION
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Reaper:-

-Knife bar	Iron casting/ steel casting/ steel forging.
-Star wheel	Acrylic material/ aluminium
-Cutter bar	High carbon steel





CAST IRON

The cast iron is obtained by re-melting **pig iron with coke and limestone** in a furnace known as **cupola**.

It is primarily an **alloy of iron and carbon**. The carbon contents in cast iron varies from 1.7 per cent to 4.5 per cent. **(2.2 - 4%)**

It also contains small amounts of **silicon, manganese, phosphorous and sulphur**. The carbon in a cast iron is present in either of the following two forms:

- Free carbon or graphite,
- Combined carbon or cementite.



GREY CAST IRON

A low cooling rate or a high carbon content produces grey cast iron.

The carbon present in free or **graphite** state

Soft, easily machined and moderately brittle

Not as **abrasive wear resistant** as *chilled cast iron*

Low tensile strength if greater amount of graphite and vice versa

High damping capacity

Used in making

Brake shoes

Cylinders

Pistons

Furrow wheel and land wheel

Slip nose share



WHITE CAST IRON

A high cooling rate (Rapid cooling) and a low carbon content favours the formation of white cast iron.

The carbon present is in combined form (cementite)

Hard and brittle

Can not be machined easily.

Requires grinding as a shaping process



CHILLED CAST IRON

Construction
S
E

***White cast iron* but *parts of the casting is chilled rapidly* to provide hard wear resistant surface.**

The depth of the chill can be controlled by composition and heat treatment.

It has ***low impact resistance.***

Uses:

Used in objects where extreme hardness and wear resistance properties are required

Slip share

Mould board

Dies, cam follower



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DUCTILE CAST IRON

High grade iron

Prepared with addition of **magnesium or cerium alloy** to the molten iron to produce **grey cast iron**. Magnesium acts as **desulphuriser**

Uses

Sprockets

Gears,

plough share,
mower guards



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WROUGHT IRON

Nearly the pure iron



Very low carbon content

Fibrous due to slag

Tough, ductile and malleable

Can be welded easily (Low carbon)

Easy to work

Carbon content : 0.05 to 0.10 %,

**Not enough carbon content to harden
through heat treatment**