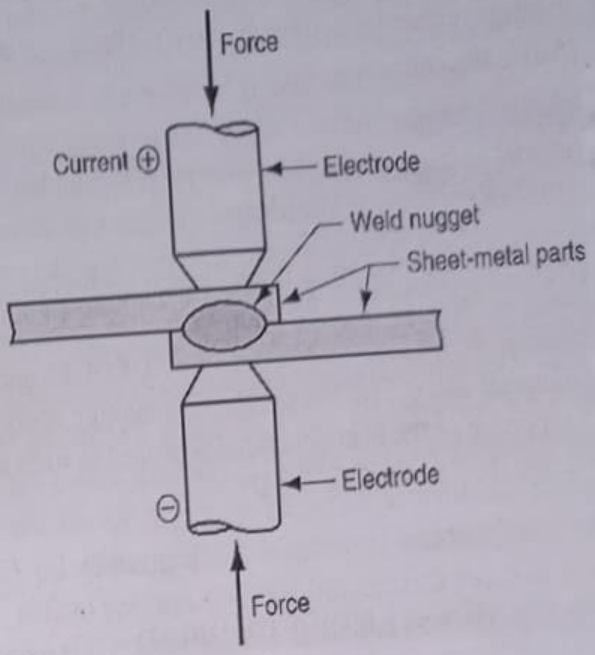
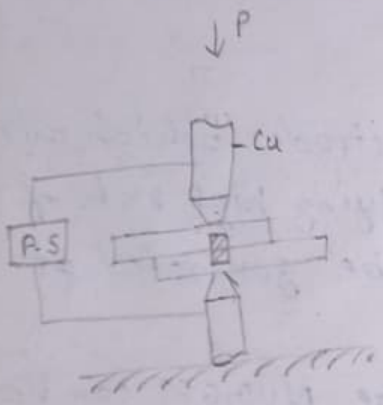
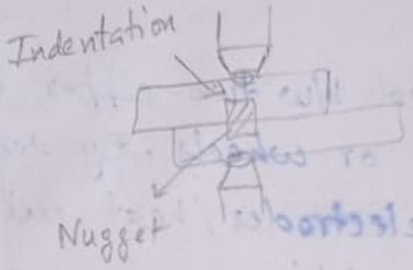
RESISTANCE WELDING

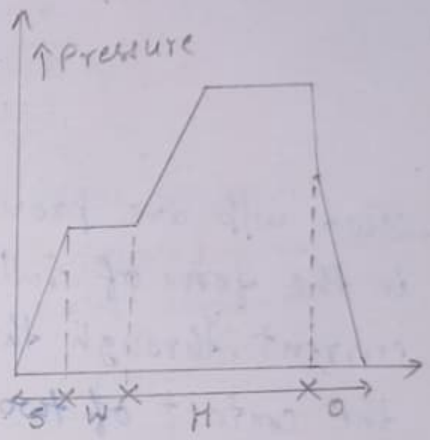
- Uses heat and pressure to join metals, the heat is generated by resistonce to an electrical current at the welding point.
- High current [10,000-15000 A]
- Supply the current till w/p become soft [$\frac{\text{Melting point}}{3}$].



(1.) SPOT WELDING







$d = 6\sqrt{t}$

$d_n = \sqrt{t}$

Volume of Nugget

$$V_n = \frac{\pi}{4} d_n^2 h_n$$

S = Squeeze time.
W = Weld time
H = Hold time.
O = Off time.

- For joining of sheet material (1-3mm)
- Two w/p are overlapped b/w copper electrodes and pressure is applied so that the surfaces of two w/p comes in physical contact with each other.
- ~~After~~ getting sufficient amount of heat, welding current is switched ~~off~~ on for a definite period of time.
- As the current passes, a small area where the w/p are in contact is heated and spot weld takes place. The temp of this weld zone is approx 815°C to 930°C.
- After welding, current is cut off. Extra electrode force is then applied or the original force is prolonged. Hold untill the metal cools down and gain strength.

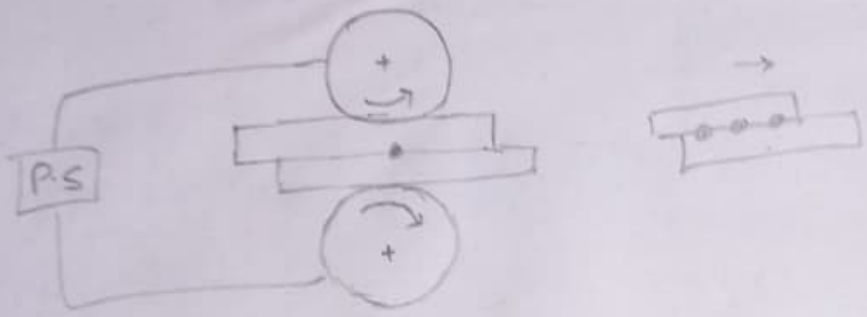
- Leak proof Joint is not possible.
- Can not be used for mass production.
- the clean surface of the workpiece become rough due to indentation.

$m = v \times s$; $H_m = m c \Delta t + m \cdot L$

$H_s = I^2 R t$

So $\eta_m = \frac{H_m}{H_s}$.

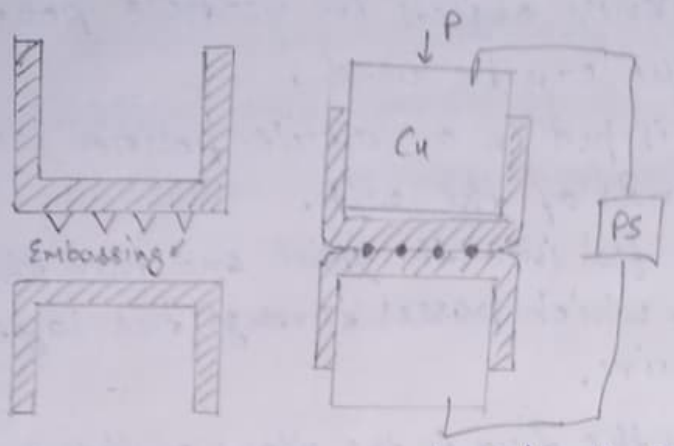
(2.) SEAM WELDING



- Two w/p are provided b/w two copper electrodes which are in the form of rollers or wheels. By supplying high rate of current, through the electrodes, heat will be generated at the contact of two workpieces.
- By rotating the rollers due to rolling pressure NUGGET can be produced b/w the two w/p.
- Due to continuous rolling pressure, there is possibility of overlapping of the nuggets, so leakproof joints can be produced.
- The pressure is not external but provided due to roller own weight.
- It can be used for mass production.

Application: fabrication of fuel tanks, Mufflers, welding of pressure vessels, radiator bodies.

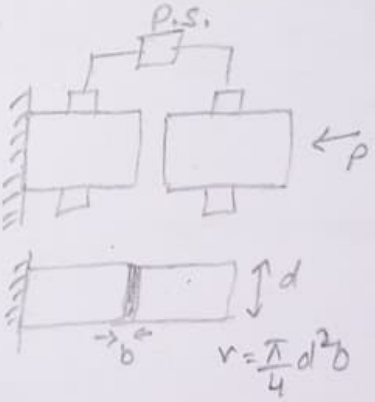
3) PROJECTION WELDING



- Two sheets which are to be welded, produce no. of projections on one of the sheet using EMBOSSING.
- By providing two sheets b/w two large sized copper electrodes, high rate of current will be supplied.
- Current melts the material at the projection.
- By switching off the power supply an external pressure can be applied to produce no. of spots at the projections.
- Leak proof joints is not possible.
- No indentation b/w electrode & w/p.
- Also known as Multi-Spot welding process.

Application:
- Small fastners, nuts etc can be welded to larger components.
- Used for welding of refrigerator condensers, joining of wires etc.
- Welding of stainless steel, titanium alloys, monel alloys etc.

4) FLASH BUTT WELDING:



Two w/p are provided b/w two copper electrode holders. By making movement of w/p close to each other, at high rate of current, flash will be produced. At the contact of the two w/p, heat will be generated due to contact resistance. After getting sufficient amount of heat, by switching off the power supply, axial pressure can be applied to produce the joints. b/w the two ends.

Application:
- Joining of mild steels, low carbon steels, aluminium alloys end to end, to produce butt joints.