$\dot{\varepsilon} = \frac{v}{h}$ → velocity of ram

h → height of the sample.

For Flow stress, servo hydraulic Pres Cam Plastometer.

DRAFT 20/05/2022

It is taper which is provided or may be inherent in the vertical surface of an element or feature of a forging.

Functions: easy removal of the forging from the die cavity.

measurement of the draft

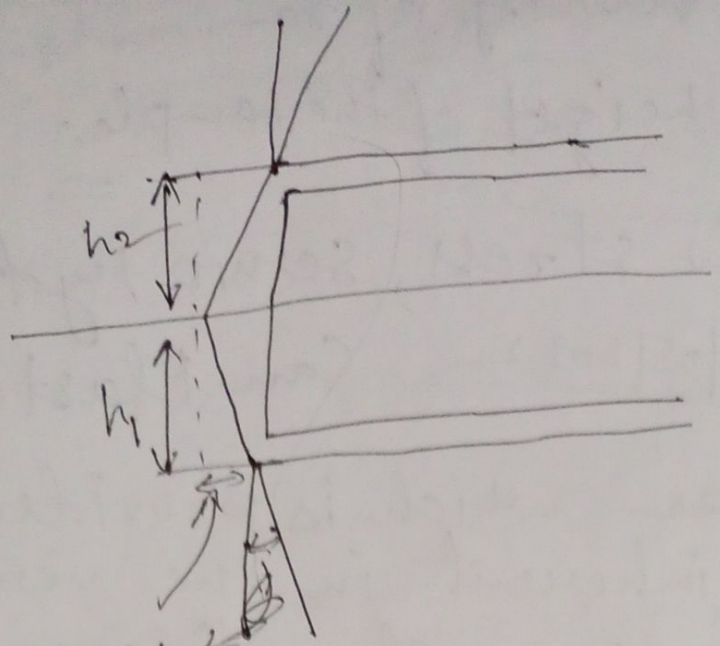
draft angle is measured in degree from vertical or axis of hammer or stroke of press.

3° - 7°

Tolerance is $\pm \frac{1}{2}°$ or $\pm 1°$

draft allowance

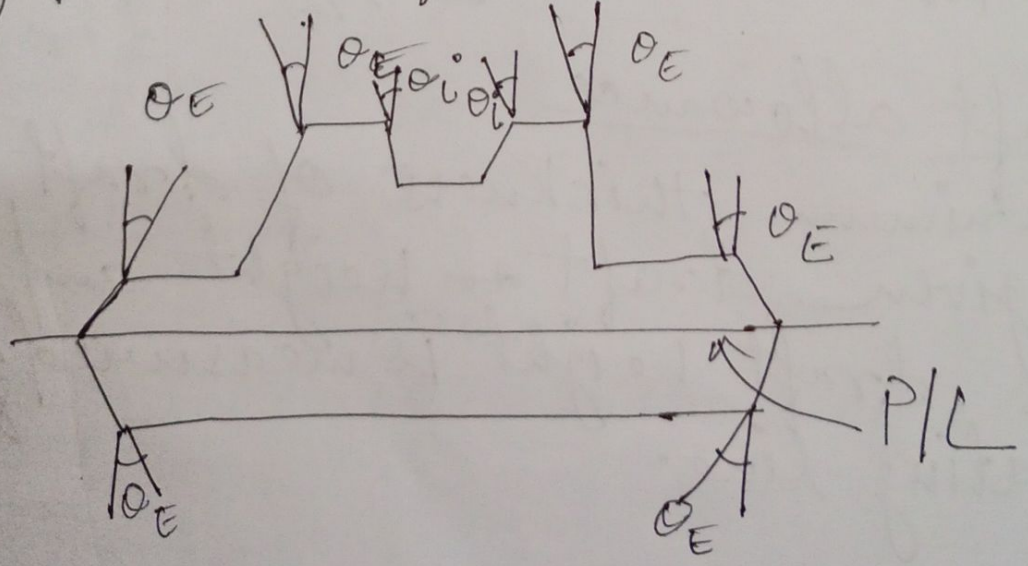
maximum thickness of draft for a given draft or height and this draft height is measured from parting line.



draft allowance

Types of draft

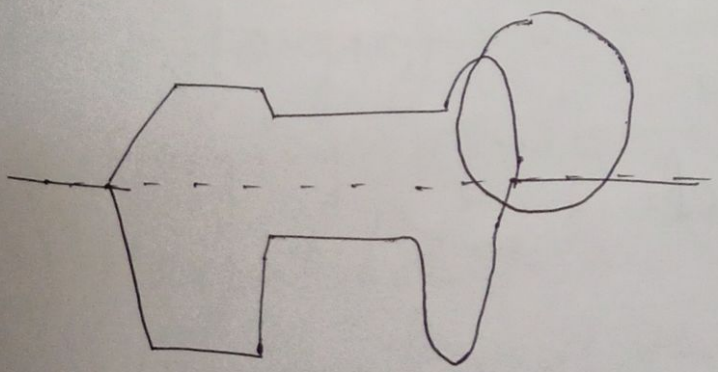
1) Outside draft (External draft)
2) Inside draft (Internal draft)
3) Match draft (Blend draft)
4) Natural draft
5) Shift draft
6) Black draft.

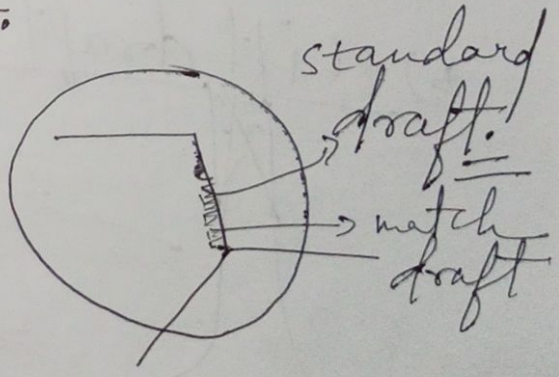


External draft -
Metal on external surface has a tendency to ~~sink~~ shrinkaway from the wall of the die cavity.

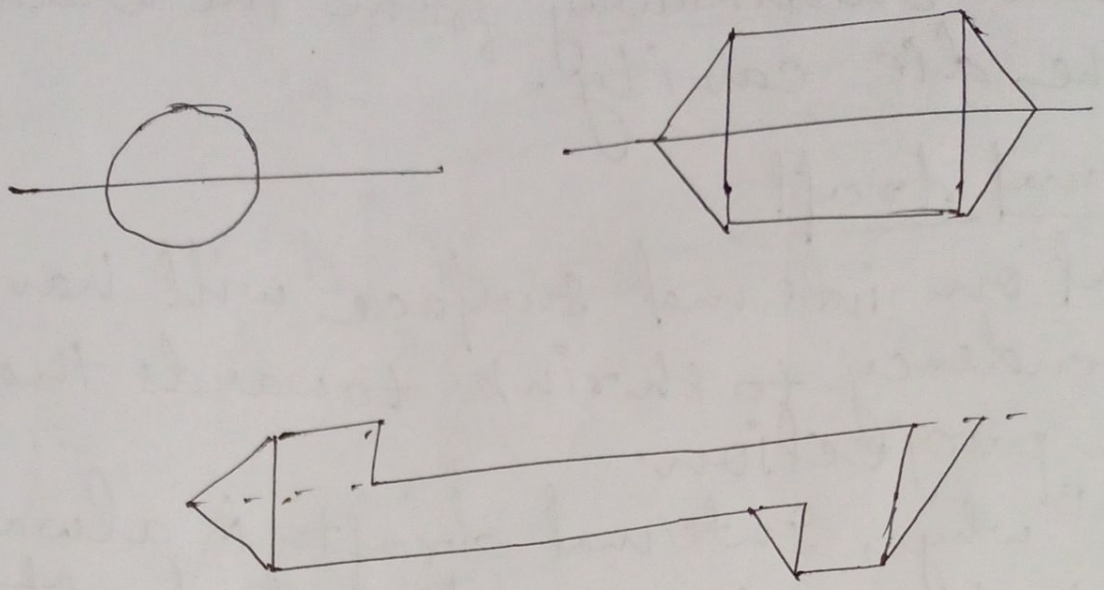
Internal draft
Metal on internal surface will have a tendency to shrink towards the die projection.
That is why, internal draft is always kept larger than external draft.

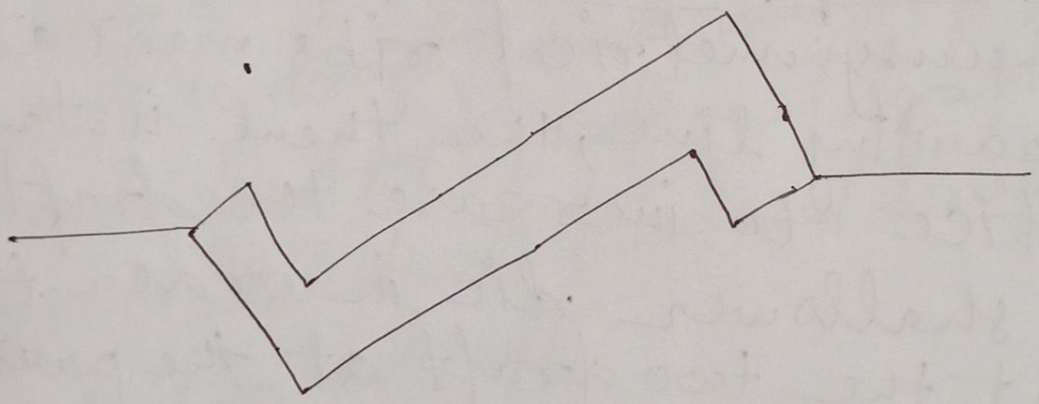
Match draft (Blend draft)
when unsymmetrical ribs meet at the parting line, then there is standard practice to increase the draft on the shallower die in order to meet the two draft at the parting line in one point.



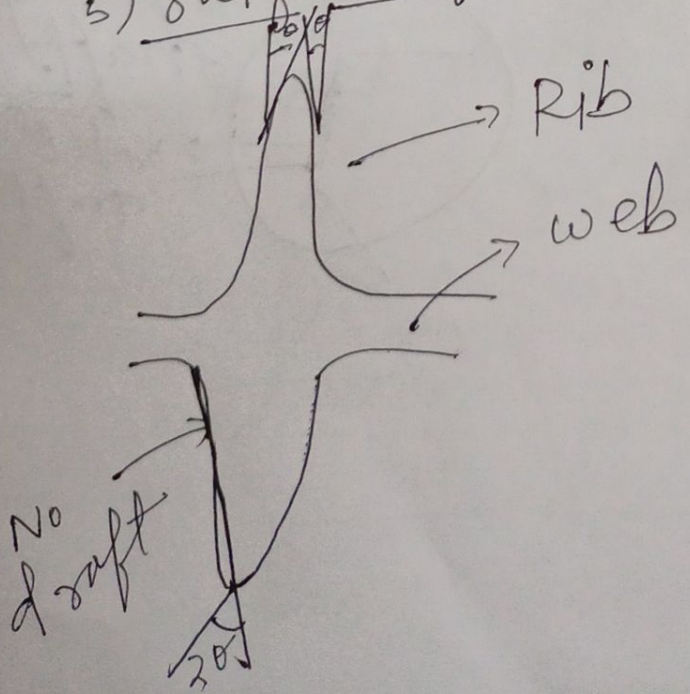


4) Natural Draft



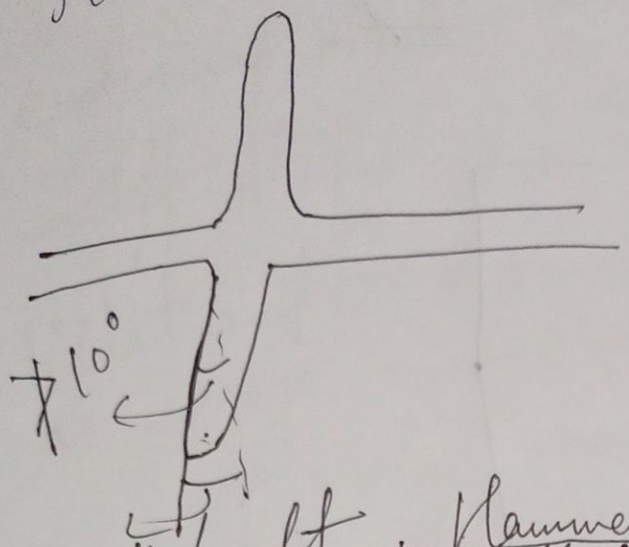


5) shift draft



6) Back draft

It is a form of shift draft.



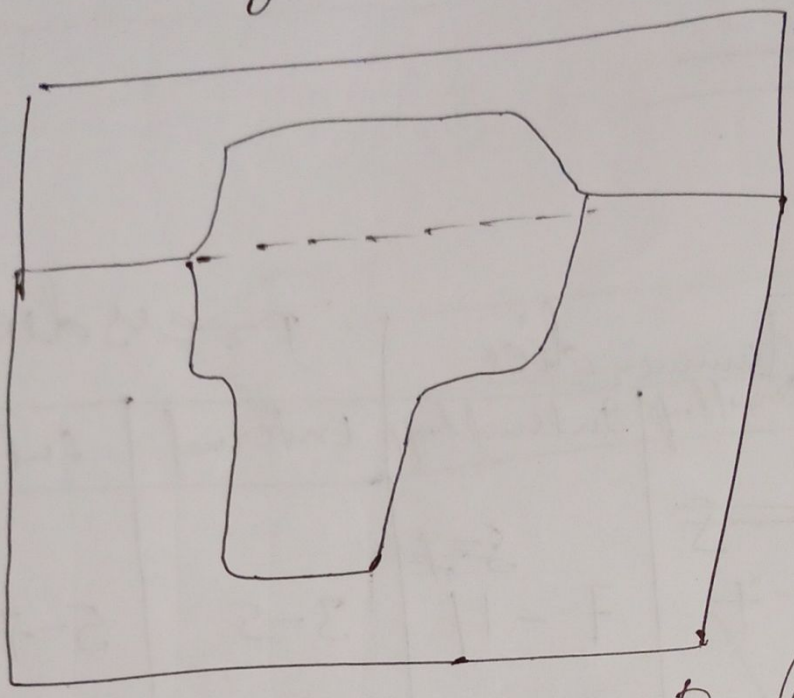
Back draft	Hammer dies		Press die	
	External draft	Internal draft	External	Internal
Al. Alloy	~~3-5~~	~~5-7~~	3-5	5-7
Steel	5-7	7-11		
SS				
Ti alloys				

Because $\pm \frac{1}{2}^\circ$ or $\pm 1^\circ$

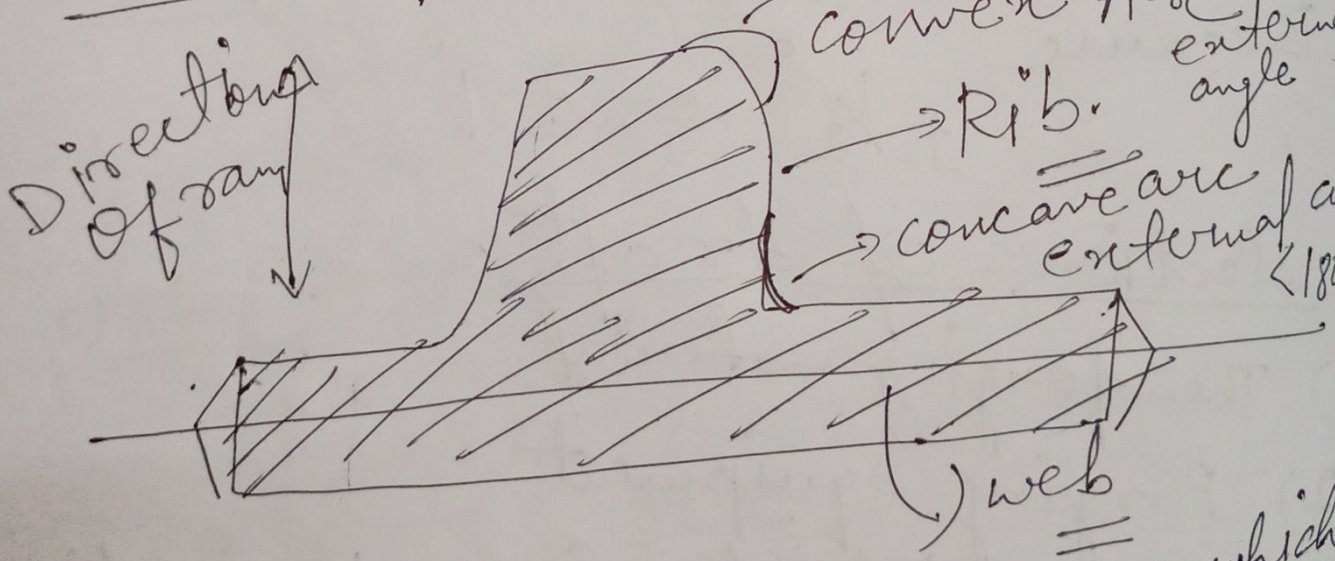
Selection of draft

1) The forging material
2) Forging equipment
3) Height / depth from the parting line (Geometry of the forging)

3° Medium carbon steel
|| Ti alloys
→ sticking



Fillet and corner Radius

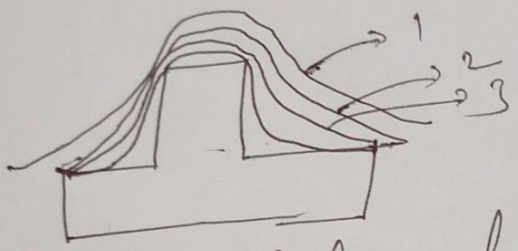


Corner - is a convex arc which is joint of two intersecting sides tangentially.

Fillet is a concave arc that joins two lines tangentially such that external angle b/w them is < 180°.

Diff. Fillet and corner

Fillet and corner radius should be as large as possible.
very very generous.



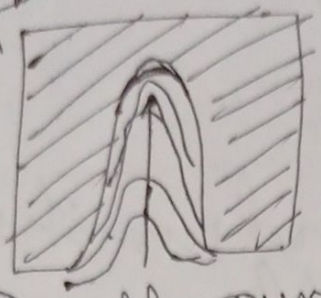
large fillet and corner radii they change the direction of metal flow gradually instead of abruptly.

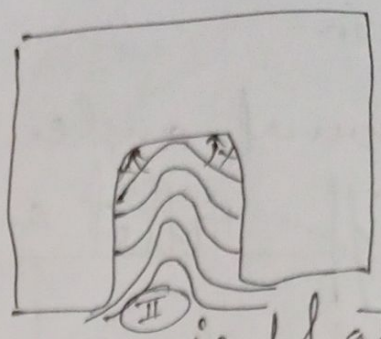
Value F and C radii depends

i) Forging materials
ii) weight of forging
iii) Height/depth from the parting line.

Role of corner in metal flow

Direction of ram movement

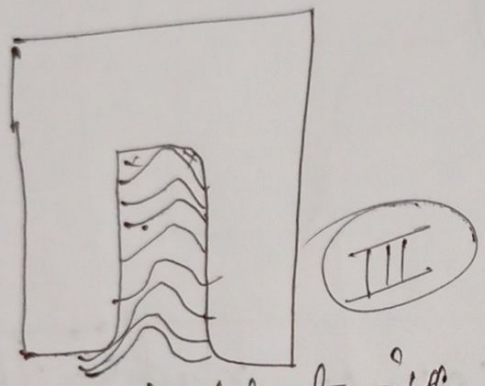




max. material required (I)

Full round Top

Top is flat with large radius



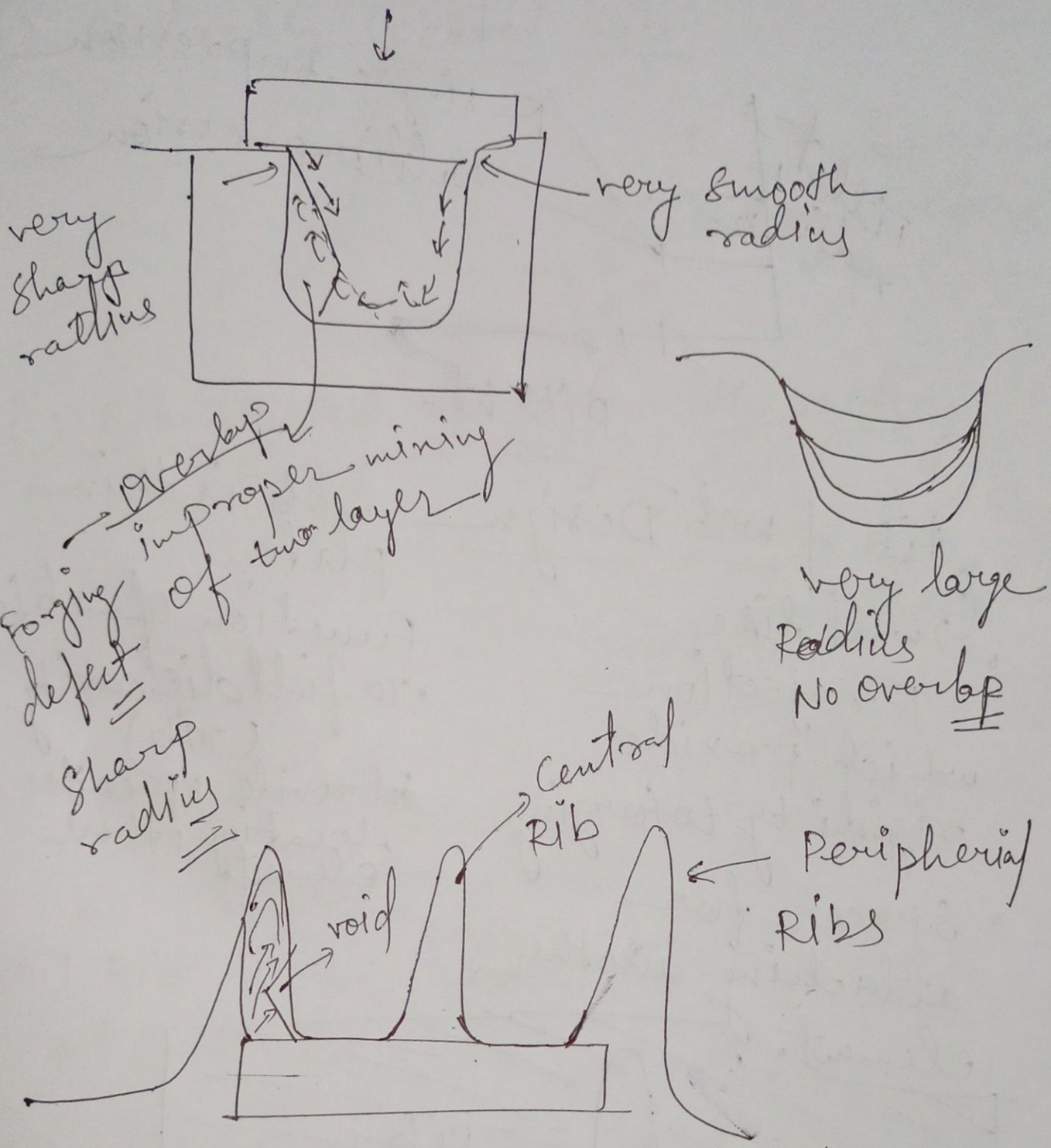
Top is flat with less radius. minimum material required

Material required I - Max. III minimum

Load required I - min II maxi.

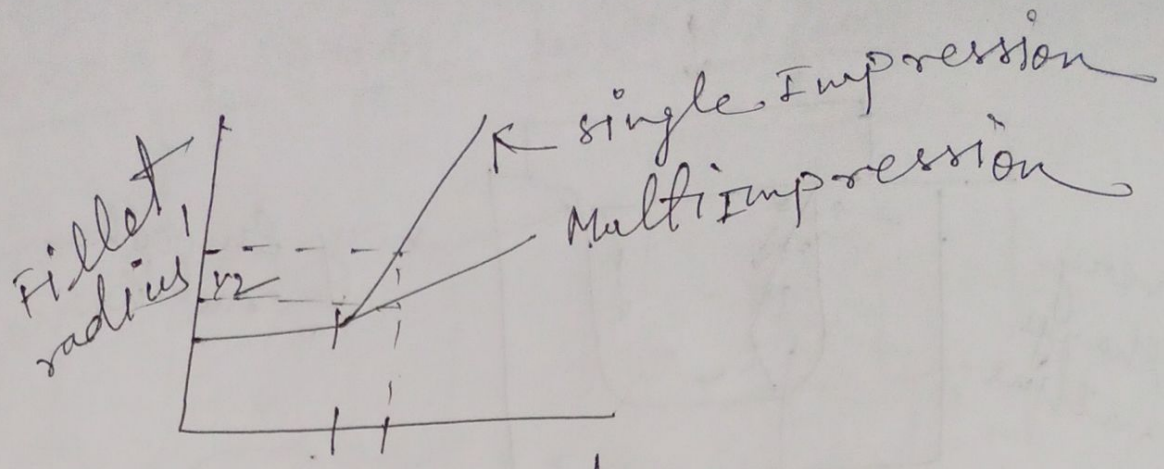
Die life I - Max III - Min

Preferred design is II.



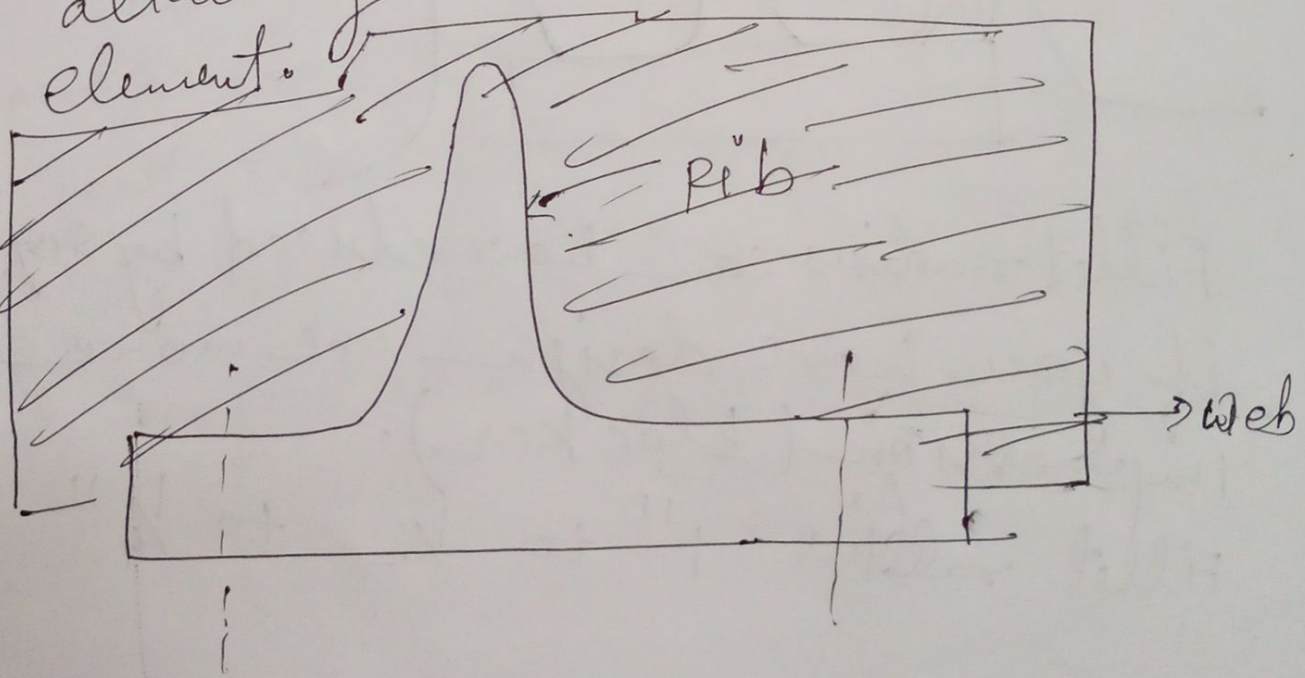
Fillet radius can be reduced by 50% if you have design one more impression (blocker).

Fillet radius 1" to 1/2" to 1/4"

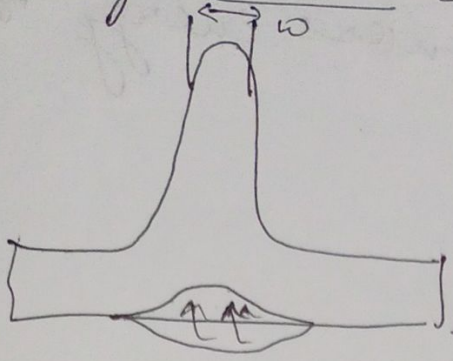


Rib & web Design

- Rib
  - wall like projection which provide rigidity to forging
  - spacer for attaching another element.
- web is thin plate
  - Function of web is
    - To fill die cavity (rib)
    - Provide space for locating other element

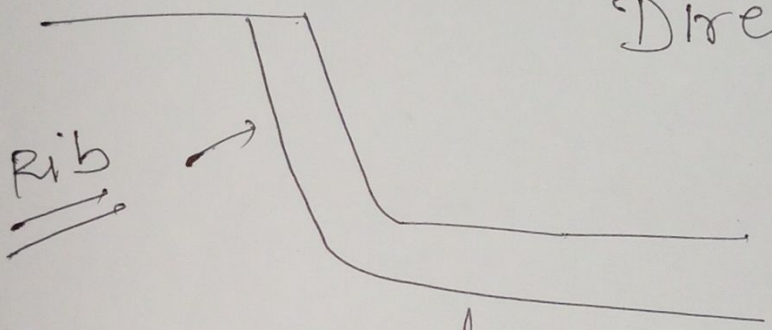


(i) Centrally located Rib



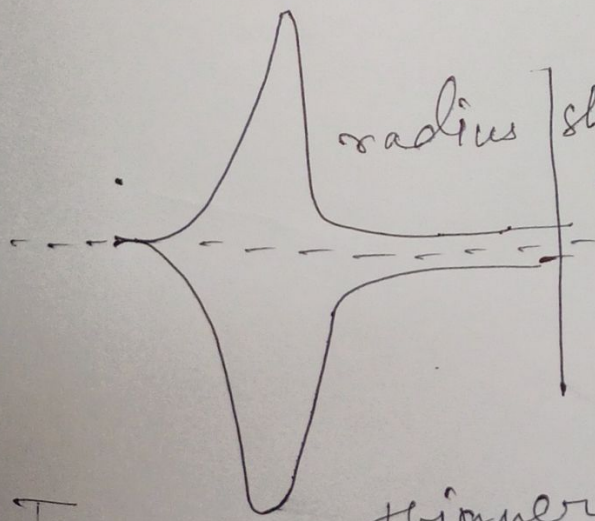
$t > w$ reverse filled by Extrusion process

(ii) Rib located at ~~side~~ edge with parting line at top



Direct extrusion process

(iii) Rib in the ~~middle~~ edge with parting at center



should be very large
More no. of preform will be required.

Two reason thinner section

1) you will find that temp. drop is fast, and crack will occur due to work hardening.

ii) more surface area, more friction, more load, more energy required.

The End