

INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ

Fourth School Year

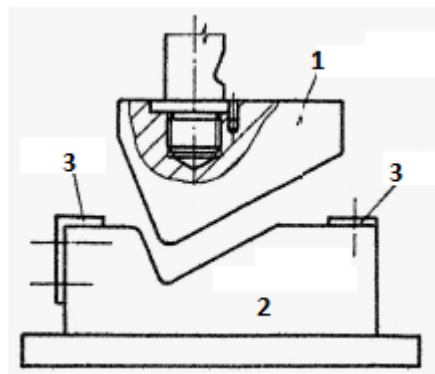
BENDING, DRAWING

Bending and **drawing** belong together with **cutting** under **pressing operations**. The reason is that the machine for all these operations is the **press**.

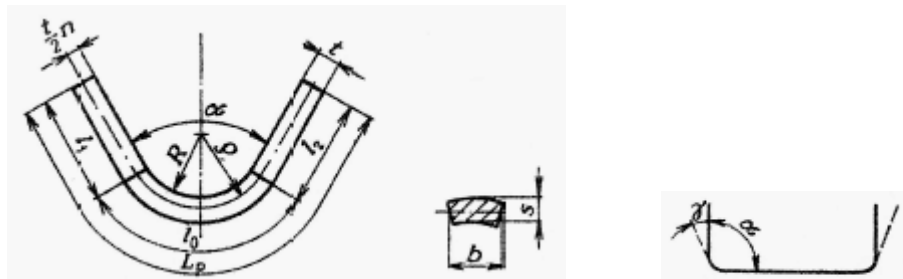
Bending

- The tool is a **bending die**.
- The **bending die** has a **fixed** part - a **fixed bending jaw** and a **movable** part – the **bending punch**.
- The semi-product for **bending** is usually a **blank**, and the product is called a **pressing**.

1...movable jaw
2...fixed jaw
3...impact



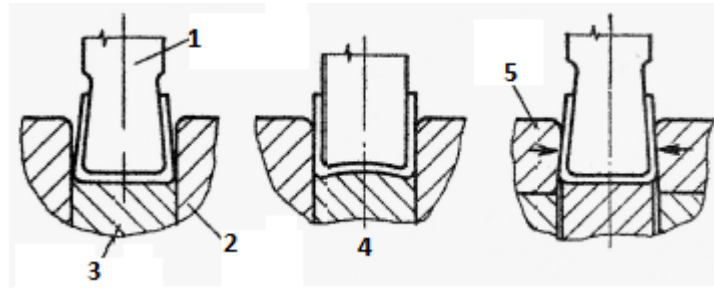
- It **bends** into a U or V shape.
- At the internal **radius** of bend R , **compression stress** acts and the material is **shortened** in a **longitudinal** direction and **expands** in a **lateral** direction.
- **Tensile stress** acts on the external **radius** of the **bend** and the material **expands** in a **longitudinal** direction and **shortens** in a **lateral** direction.
- Between the **compression** and **tensile stress** there is a layer without **tension** – the **neutral axis**.
- The neutral axis is not in the middle, but is shifted to the internal side of the **bend**.
- We determine the length of the semi-product by using the neutral axis.



- In material **bending** elastic and permanent deformation are set.
- Under the influence of elastic deformation a material **deflects** back to the original angle γ .
- When we design **bending** tools we have to keep this angle in mind.
- When **bending** into a V shape opening angle α decreases by original angle γ .

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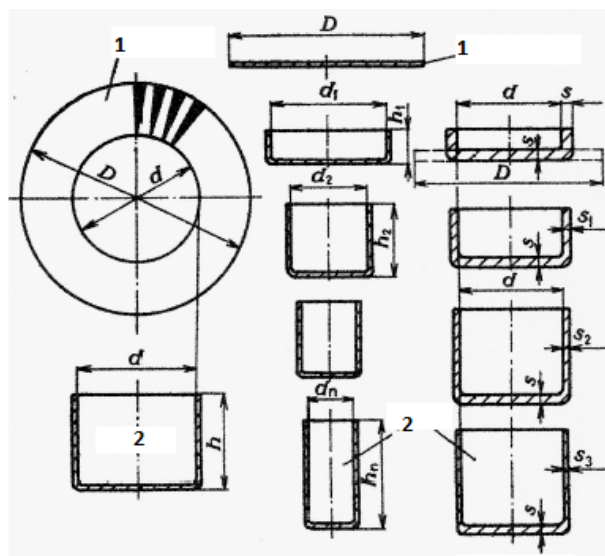
- When **bending** into a U shape there is either a structural tool correction or shaping using side **jaws**.



- 1...**chamfering movable jaw**
2...**fixed jaw**
3...**holder**
4...**rounding-off**
5...**calibrating using side jaws**

Drawing

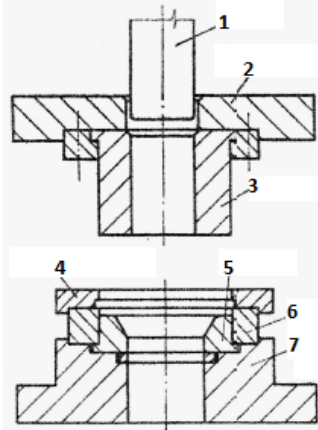
- The tool is a **drawing die**. It has a **fixed** part - the **fixed drawing jaw** and the **movable drawing punch**. **Drawing** produces a **cup**.
- When **drawing hollow vessels** (shapes) are made.
- Simple and smaller **cup** depths are produced with one **drawing**. More complicated and deeper depths are produced with more **drawings**.
- Drawing** a material leads to its deformation **solidification** (normal **annealing** is carried out between individual **drawings**).
- A **holder** is used so that waves or **laps** are not formed on **cup** peripheries.
- Cups** are produced by decreasing diameters or **thinning** walls.



- 1...semi-product
2...**cup**
Drawing tool

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- 1...drawing punch
- 2...clamping plate
- 3...holder
- 4...base plate
- 5...fixed drawing die
- 6...chuck
- 7...base plate

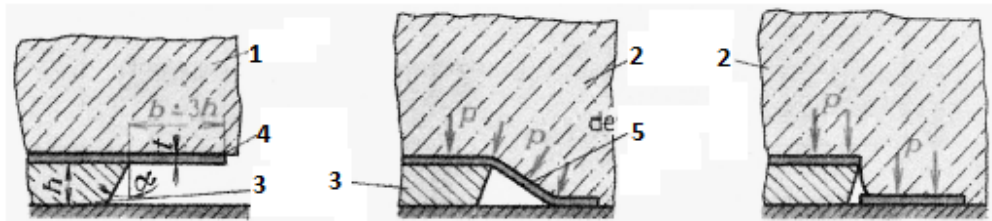


Examples of products produced by **bending** and **drawing**: *utensils, vessels, sinks, gas cylinders...*

Special methods of **bending** and **drawing**

- **Rubber** and liquid are used for them.
- They are used for a smaller number of produced pieces (**rubber** is quickly **worn out**).

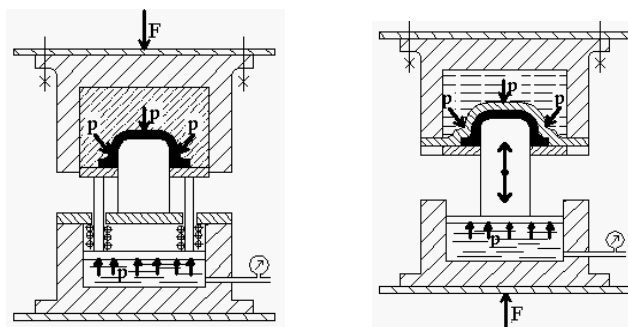
The Guerin Method – **cutting** and **bending** with **rubber**



- 1...rubber – punching die
- 2...compressed rubber
- 3...tool – punch
- 4...plate
- 5...deformed plate

The Marform Method – **drawing** with **rubber**

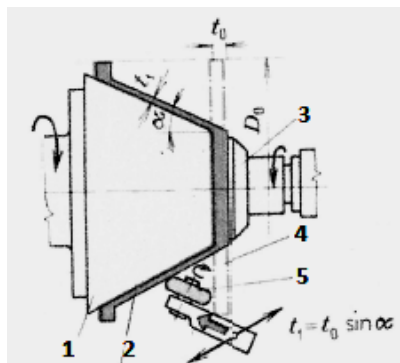
The Hydroform Method – **drawing** using liquid, closed in a steel box, **partitioned** by a **rubber** membrane



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Rotary pressing of plates

- 1...metal *mould*
- 2...product
- 3...pressure *flange*
- 4...semi-product
- 5...pressure *roller*



Literature and sources used: Augustin Frank a kol., Strojírenská technologie 4, SNTL, Miroslav Hluchý a kol., Strojírenská technologie 2, SNTL

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VOCABULARY

annealing	žihání	impact	doraz
base plate	zakládací deska	jaw	čelist
bend	ohyb, ohýbat	lap	přehyb
bending	ohýbání	lateral	příčný
bending die	ohýbadlo	longitudinal	podélný
bending jaw	ohybnice	mould	forma
bending punch	ohybník	movable	pohyblivý
blank	výstřižek (plechu)	partition	předělit, rozdělit
chamfering	zkosený	plate	plech
chuck	objímka	press	lis, lisovat
clamping plate	upínací deska	pressing	lisování, výlisek
compression	tlak	punching die	střižnice
cup	výtažek (z plechu)	radius	poloměr
cutting	stříhání, řezání	roller	kladka
deflect	vychýlit	rounding-off	zaoblení
draw	tah, tahat	rubber	pryž
drawing	tažení	shorten	zkracovat, zkrátit
drawing die	tažidlo	sink	dřez
drawing jaw	tažnice	solidification	zpevnění
drawing punch	tažník	stress	napětí, namáhat
expand	roztahovat	tensile stress	tahové napětí
fixed	pevný	tension	napětí
flange	příruba	thinning	ztenčování
gas cylinder	láhev na plyn	utensil	příbor
holder	přidržovač	vessel	nádoba
hollow	dutý	worn out	opotřebovaný

COMPREHENSION QUESTIONS

1. What do you know about bending?
2. What is the neutral axis in bending?
3. What do you remember about drawing?
4. What special methods of bending and drawing do we have?
5. Can you name some products produced by bending and drawing?

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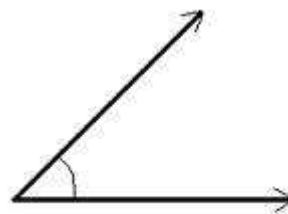
EXERCISES

1. Name what you see in the pictures:

1



2



3



4



5



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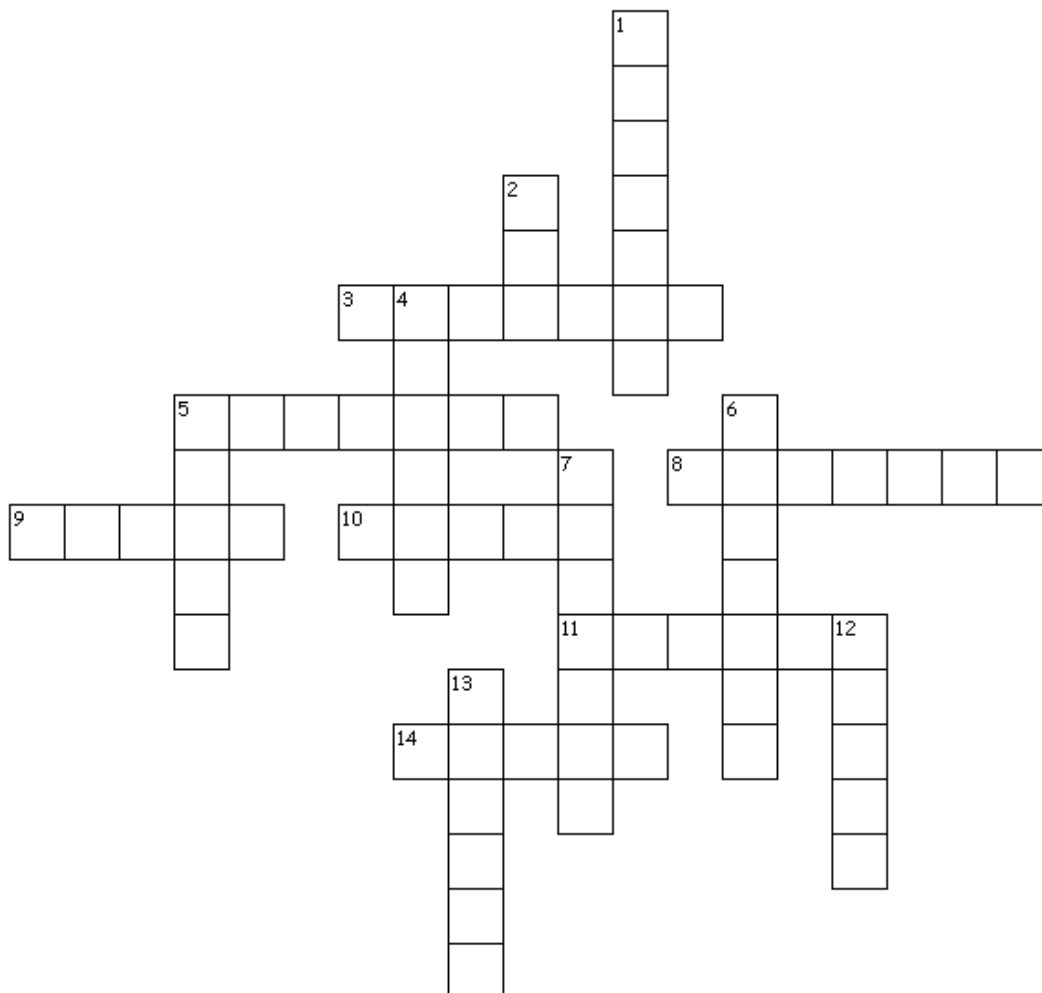
2. Criss Cross Puzzle - 15 words were placed into the puzzle.

Across

- 3. tažení
- 5. pohyblivý
- 8. ohýbání
- 9. plech
- 10. hloubka
- 11. poloměr
- 14. pevný

Down

- 1. stříhání
- 2. čelist
- 4. pryž
- 5. kov
- 6. napětí
- 7. zkracovat
- 12. ocel
- 13. kapalina



3. Grammar Corner – Complete the sentences. Put the verb into the correct form, positive or negative.

- 1 It was warm, so I _____ off my coat. (take)
- 2 The film wasn't very good. I _____ it very much. (enjoy)
- 3 I knew Sarah was very busy, so I _____ her. (disturb)
- 4 I was very tired, so I _____ the party early. (leave)
- 5 The bed was very uncomfortable. I _____ very well. (sleep)
- 6 The window was open and a bird _____ into the room. (fly)
- 7 The hotel wasn't very expensive. It _____ very much. (cost)
- 8 I was in a hurry, so I _____ time to phone you. (have)
- 9 It was hard carrying the bags. They _____ very heavy. (be)

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KEY FOR TEACHERS**1. Name what you see in the pictures:**

- 1 cylinder
- 2 angle
- 3 bending
- 4 sink
- 5 utensil

2. Criss Cross Puzzle

rubber	pryž
plate	plech
radius	poloměr
bending	ohýbání
drawing	tažení
shorten	zkracovat
cutting	stříhání
movable	pohyblivý
fixed	pevný
depth	hloubka
metal	kov
steel	ocel
jaw	čelist
tension	napětí
liquid	kapalina

3. Grammar corner

- 1 It was warm, so I **took** off my coat. (take)
- 2 The film wasn't very good. I **didn't enjoy** it very much. (enjoy)
- 3 I knew Sarah was very busy, so I **didn't disturb** her. (disturb)
- 4 I was very tired, so I **left** the party early. (leave)
- 5 The bed was very uncomfortable. I **didn't sleep** very well. (sleep)
- 6 The window was open and a bird **flew** into the room. (fly)
- 7 The hotel wasn't very expensive. It **didn't cost** very much. (cost)
- 8 I was in a hurry, so I **didn't have** time to phone you. (have)
- 9 It was hard carrying the bags. They **were** very heavy. (be)