

**Illustrated Knowledge Metal Engineering/Basic – Bildreihen für die
Grundstufe Metall**

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Illustrated Knowledge Metal Engineering/Basic – Bildreihen für die Grundstufe Metall

Helmut Pfisterer

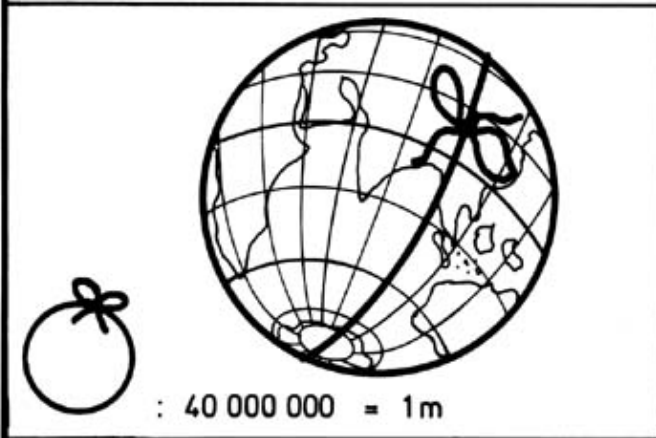


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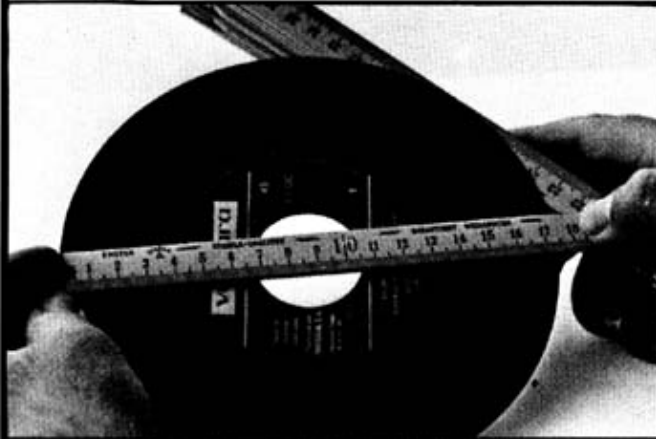
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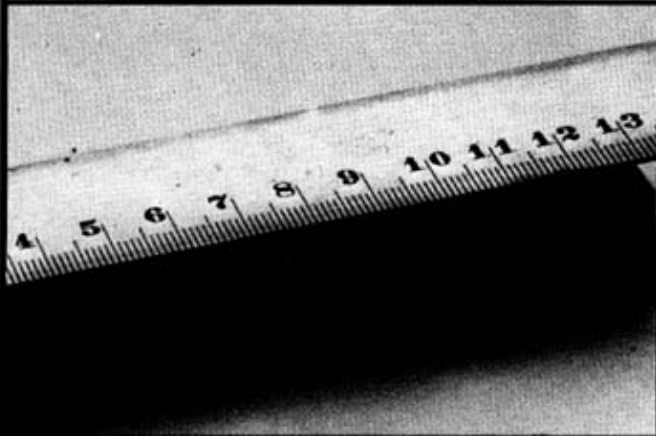
1. Measuring and testing – Messen und Testen



_____ 1.1



_____ 1.2



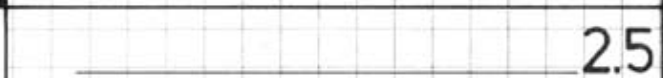
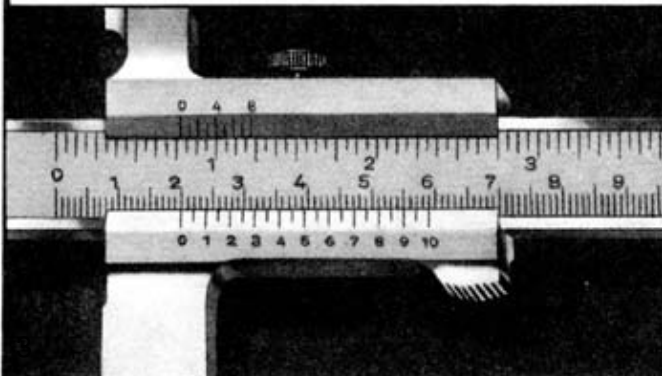
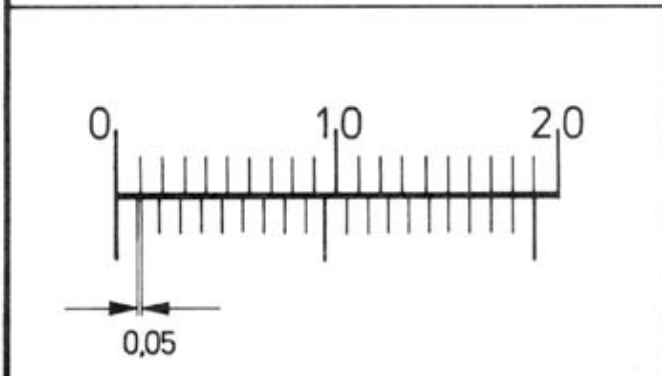
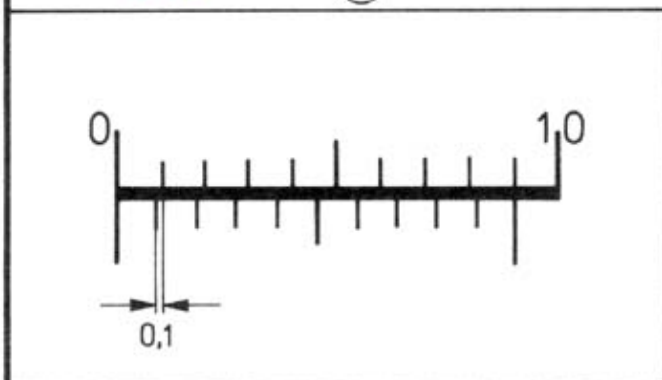
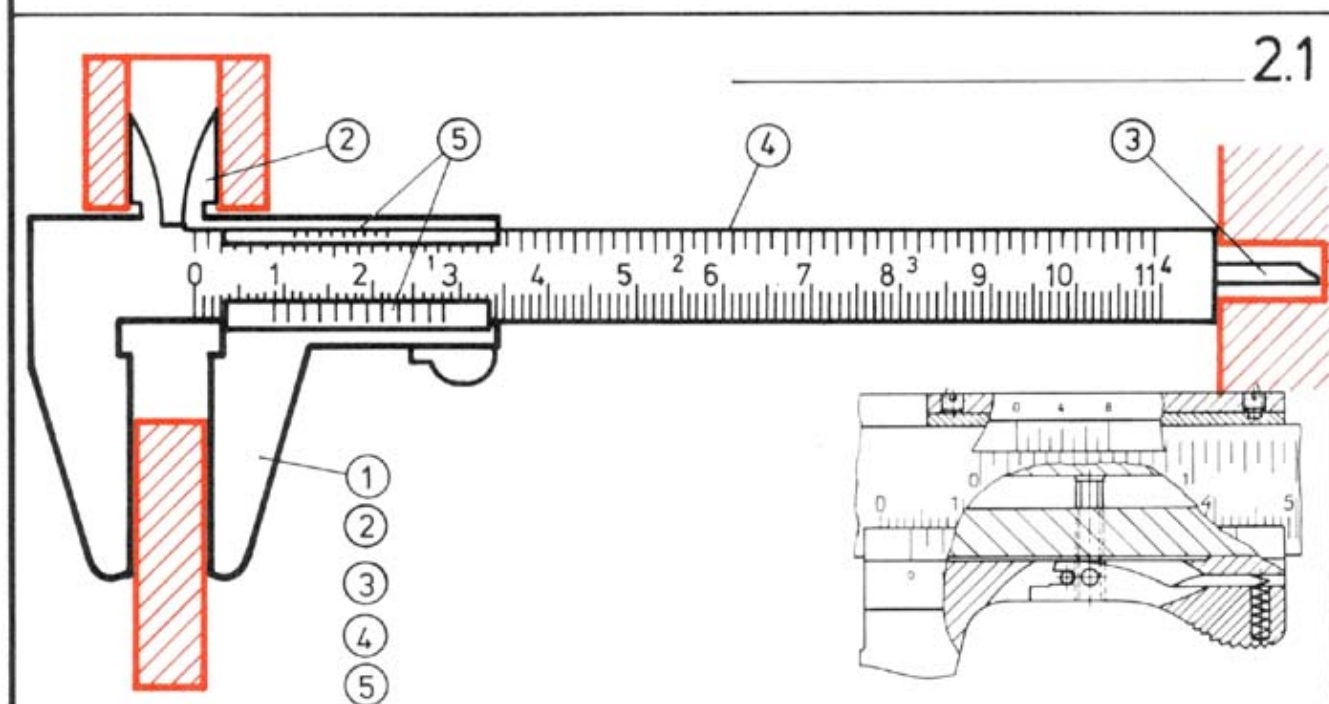
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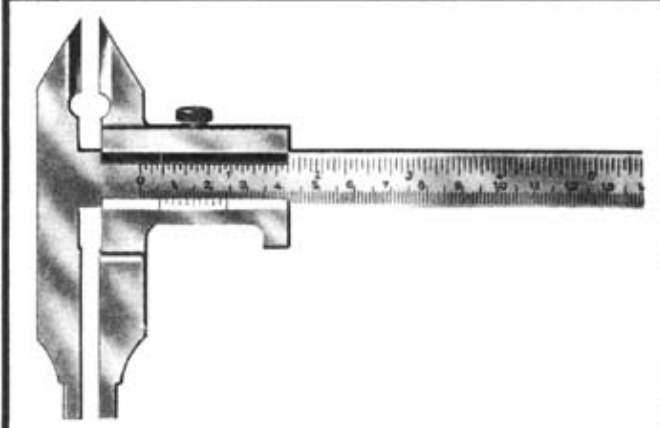


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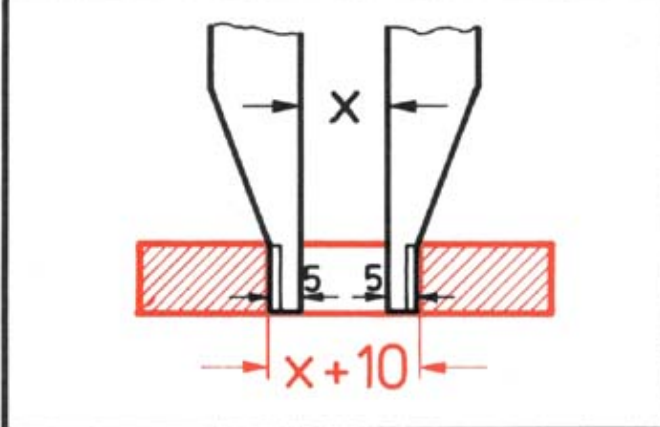


_____ 1.5

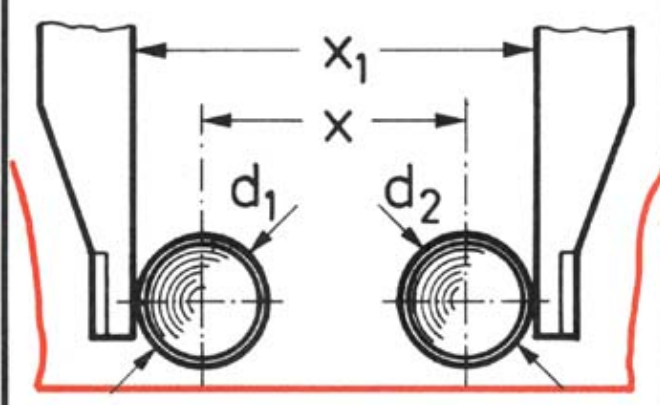




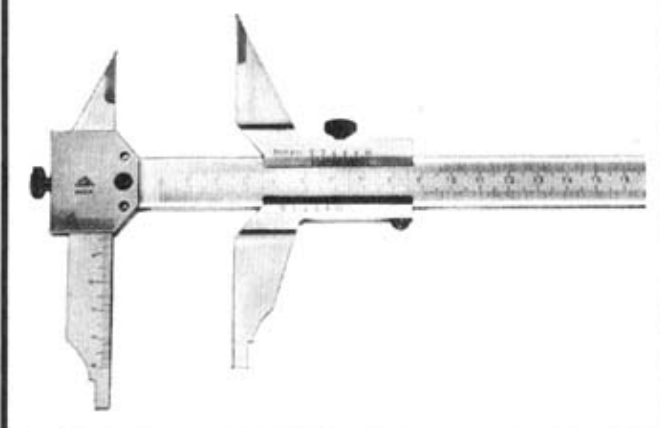
3.1



3.2



3.3

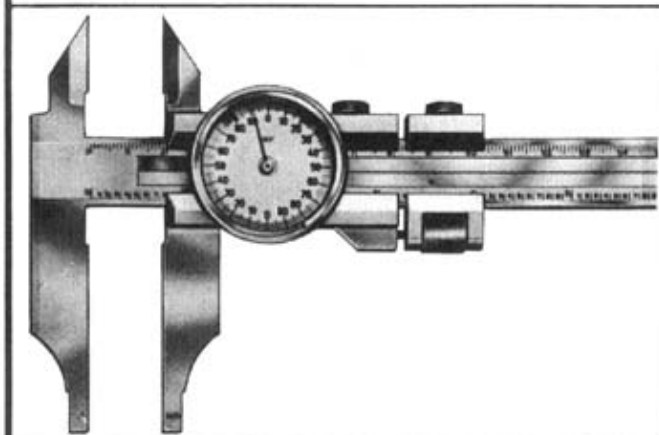


3.4



3.5

3a



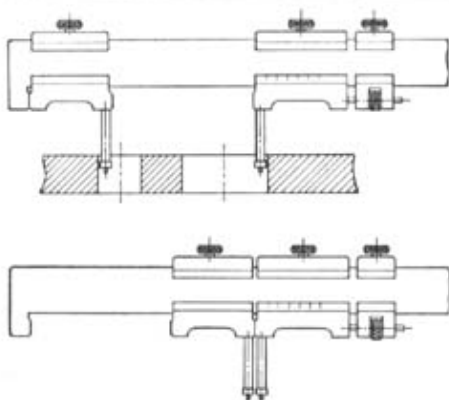
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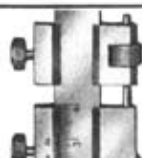


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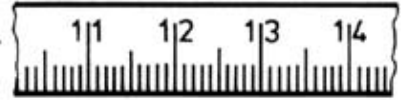


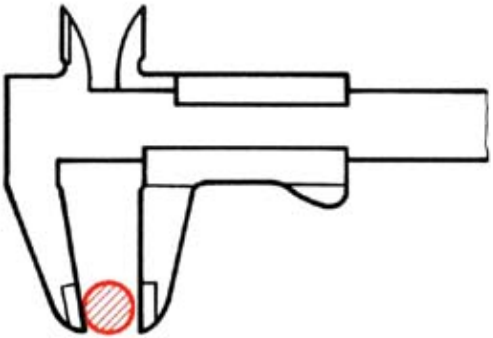
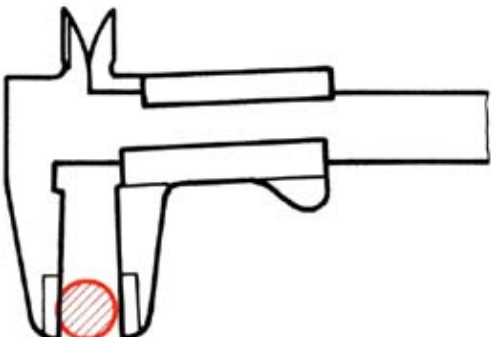
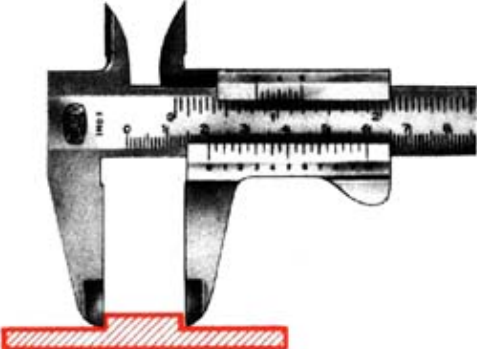
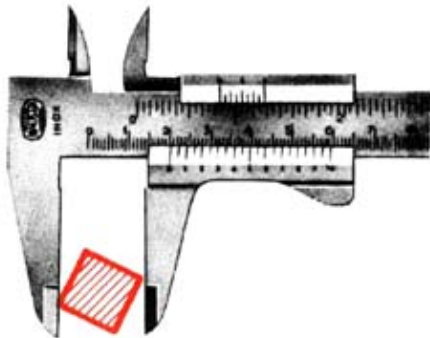

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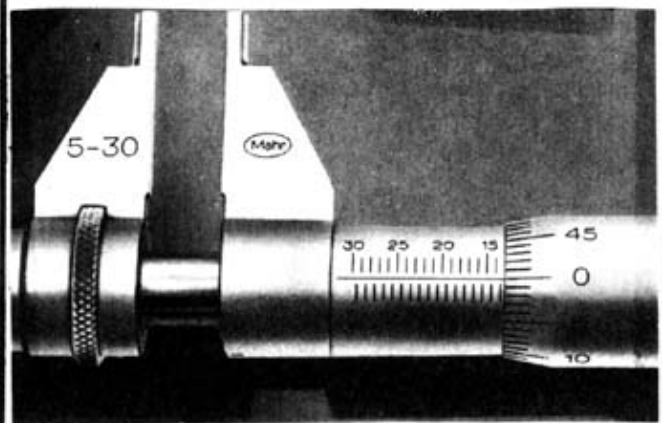
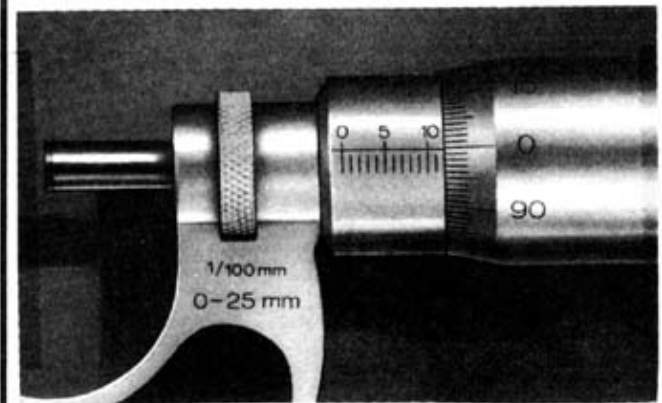
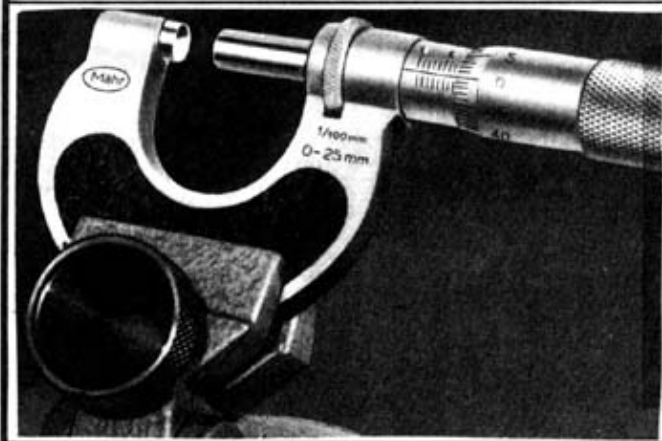
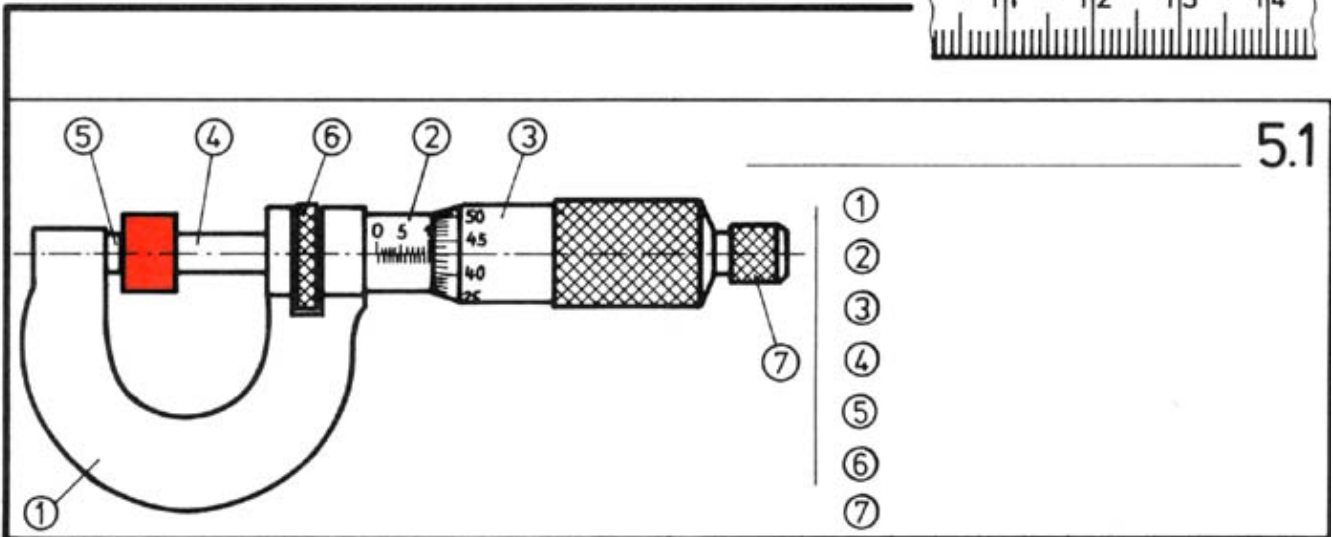
5



3.5



	<p>_____ 4.1</p>
	<p>_____ 4.2</p>
	<p>_____ 4.3</p>
	<p>_____ 4.4</p>
	<p>_____ 4.5</p>



5.1

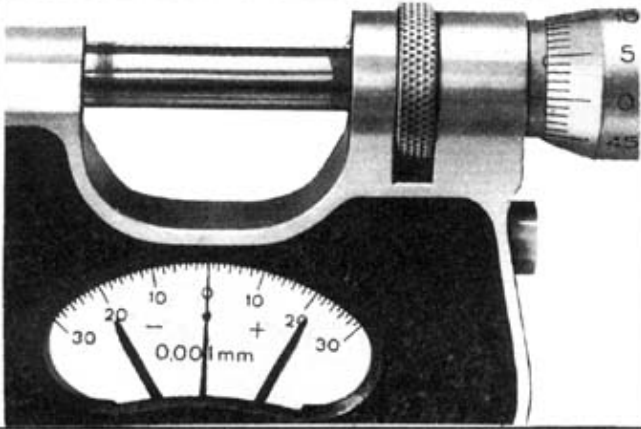
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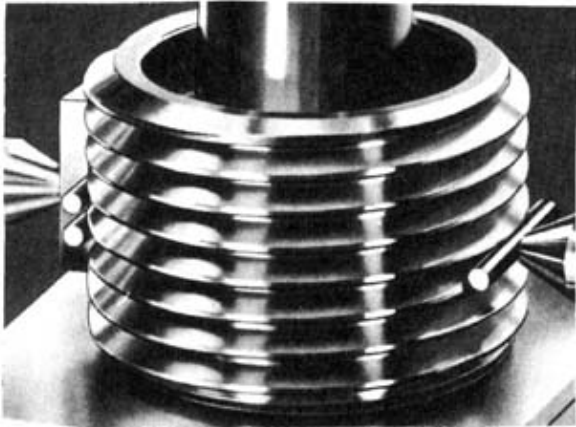
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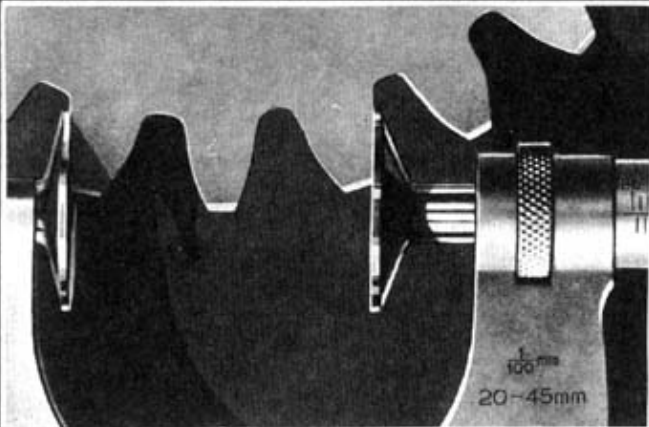
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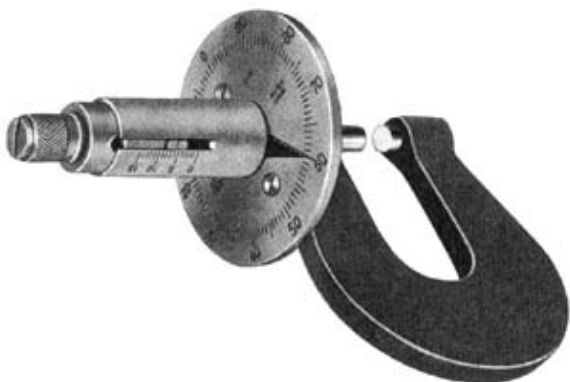
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5.2



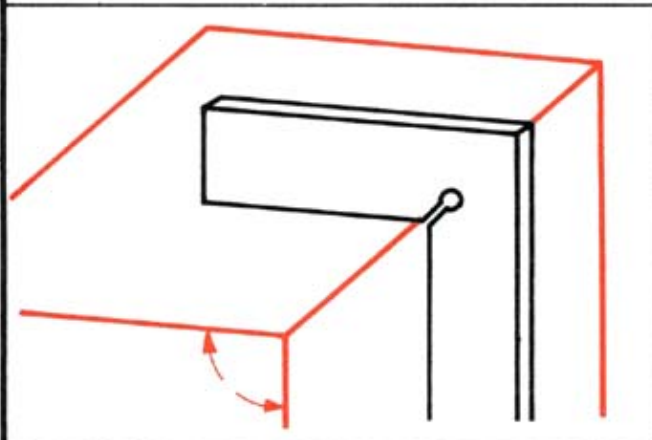
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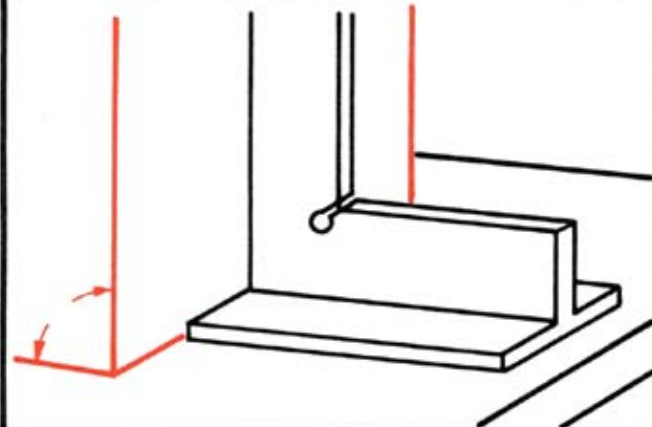
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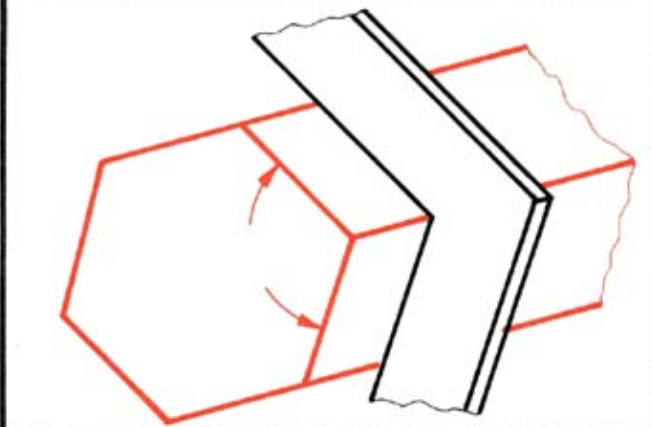
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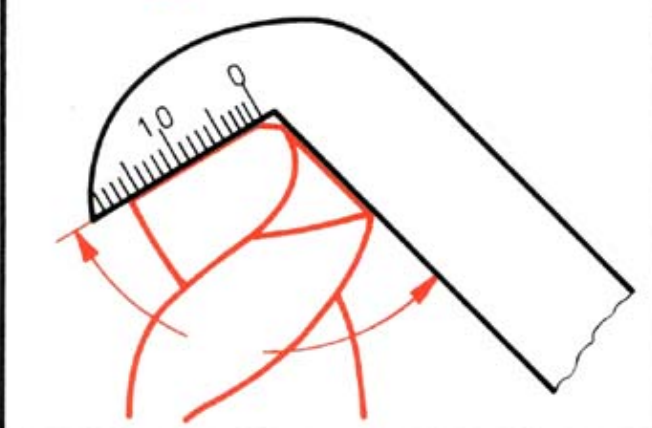
_____ 6.1



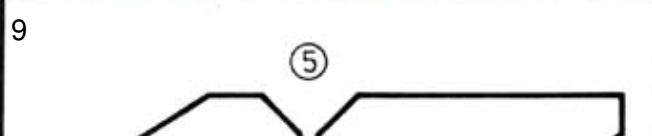
_____ 6.2



_____ 6.3



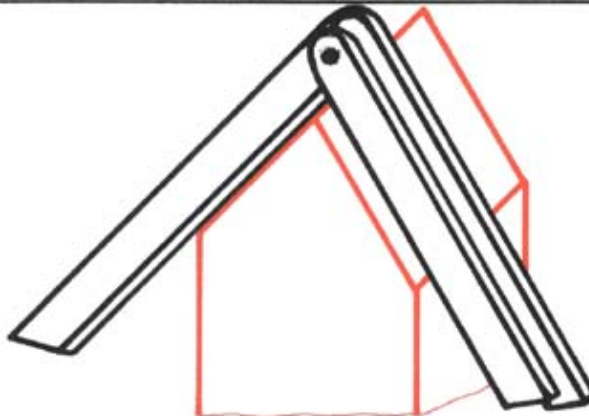
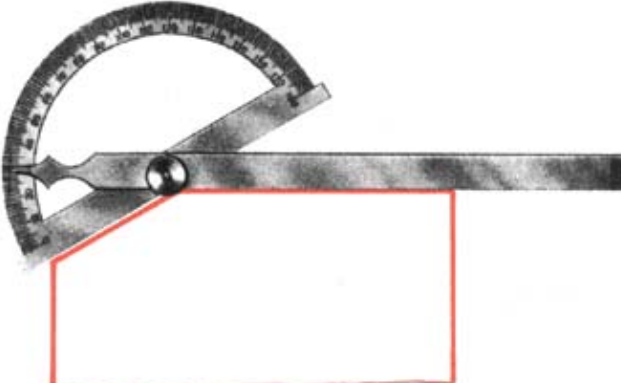
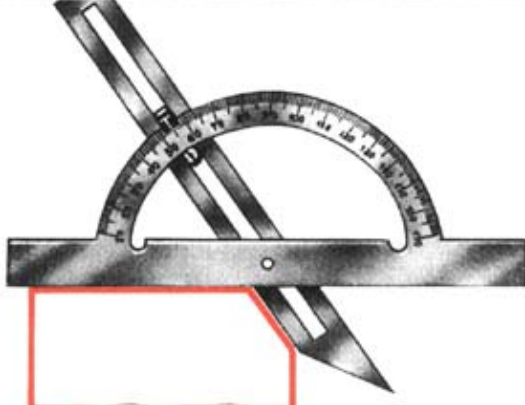
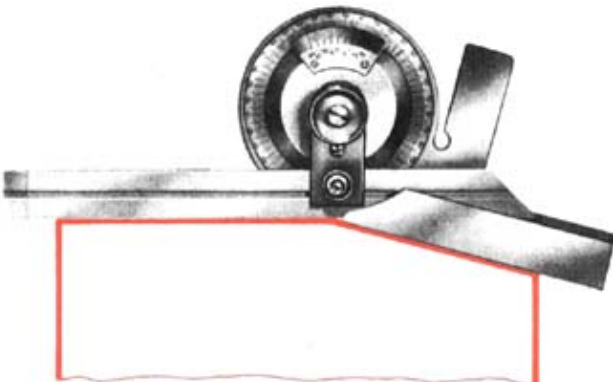

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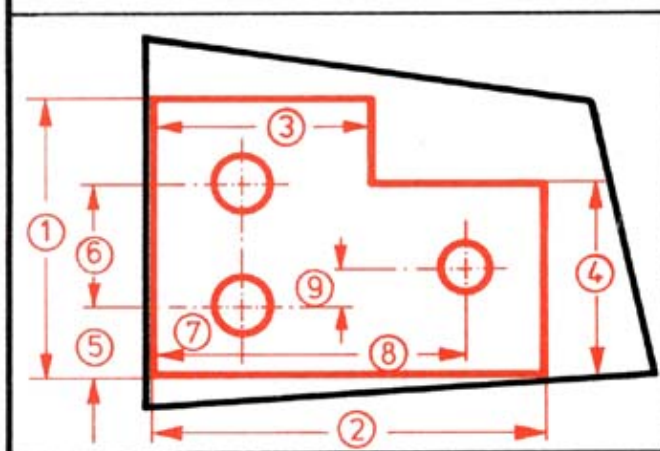
9 _____ 6.5

①



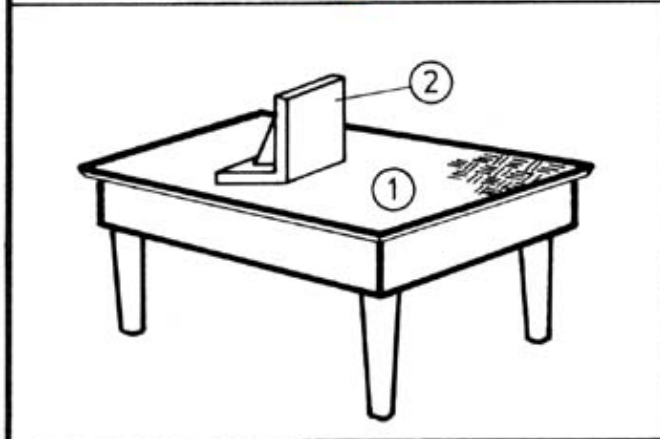
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	<p>_____ 7.2</p>
	<p>_____ 7.3</p>
	<p>_____ 7.4</p>
	<p>_____ 7.5</p>

2. Marking/Punch marking – Markierung/Schlagstempelmarkierung



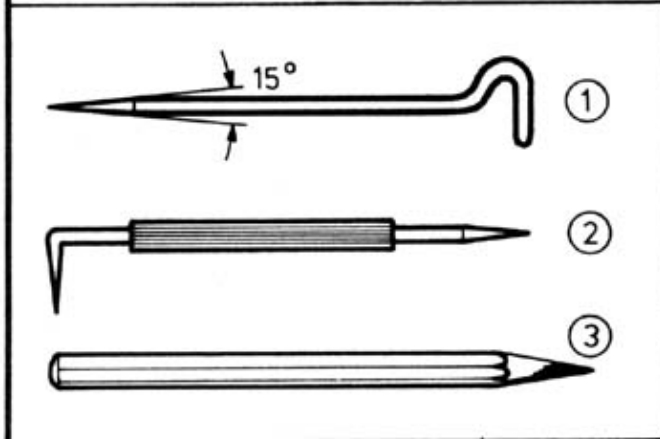
1.1

①
② ③
④
⑤ ⑥ ⑨
⑦ ⑧



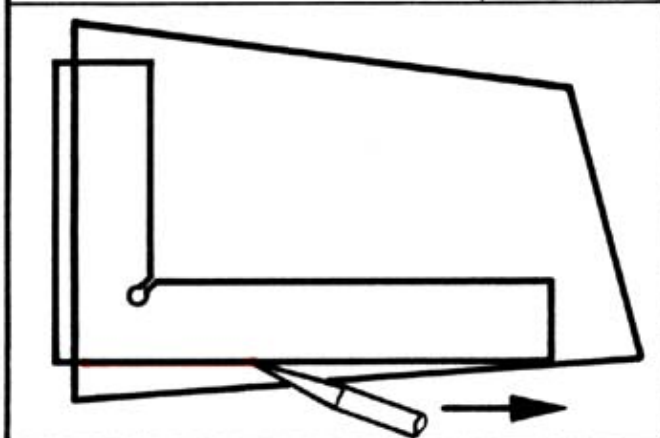
1.2

①
②

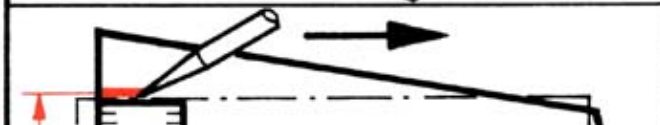


1.3

①
②
③



1.4




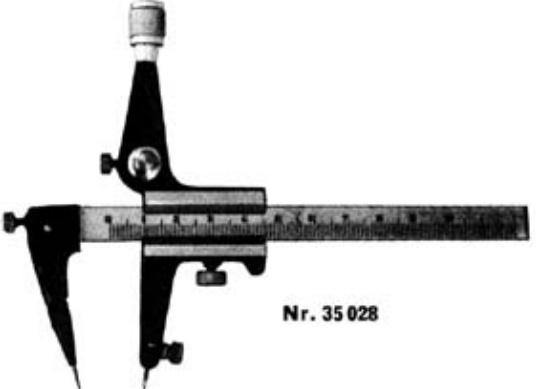






1.5¹²



	2.1 <hr/>
	2.2 <hr/>
	2.3 <hr/>
	2.4 <hr/>
13 	2.5 <hr/>



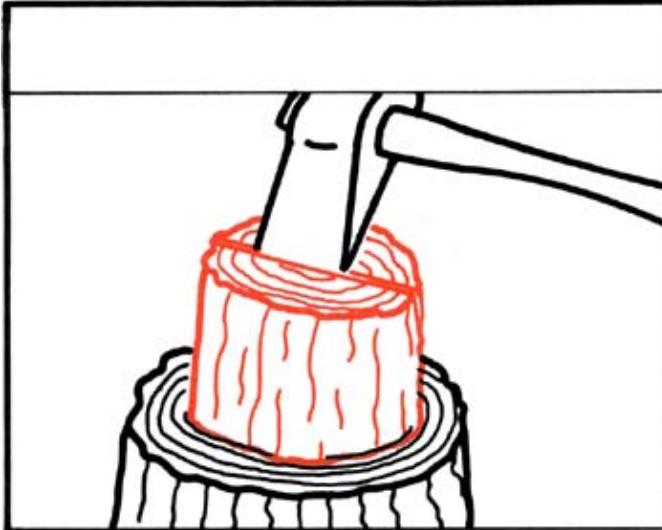
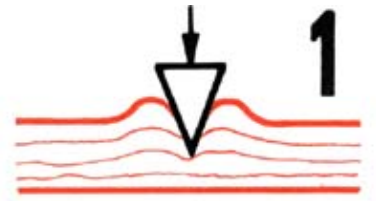
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	<p>_____ 3.2</p> <p></p>
	<p>_____ 3.3</p> <p></p>
	<p>_____ 3.4</p>
	<p>_____ 3.5</p>



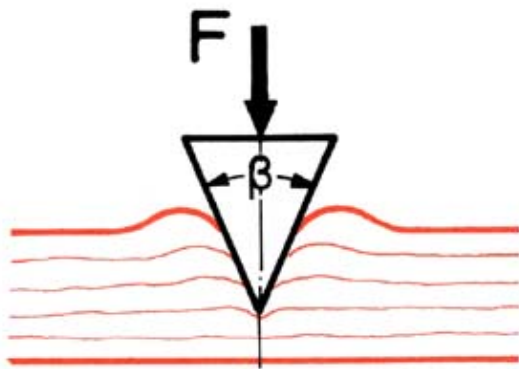
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	<p style="text-align: right;">4.4</p> <hr/>



3. Chipping – Meißeln



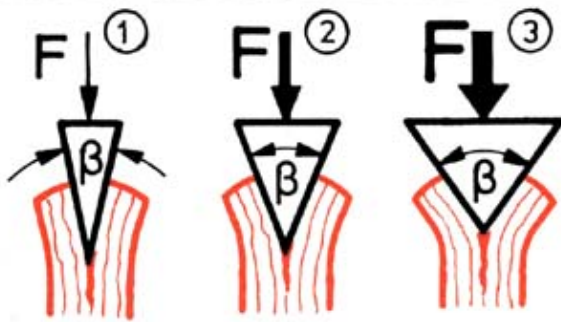
1.1



1.2

$$F =$$

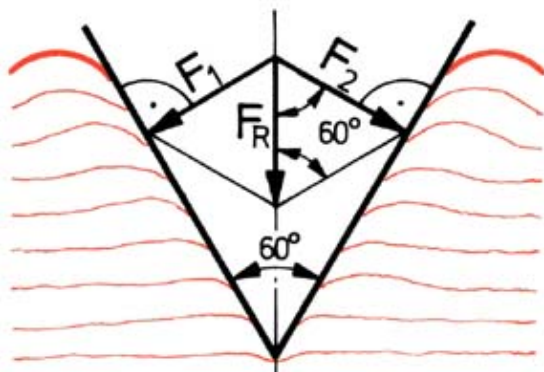
$$\sphericalangle \beta =$$



1.3

- ①
- ②
- ③

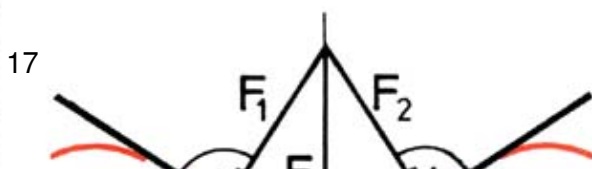
$$\sphericalangle \beta \hat{=} F$$



1.4

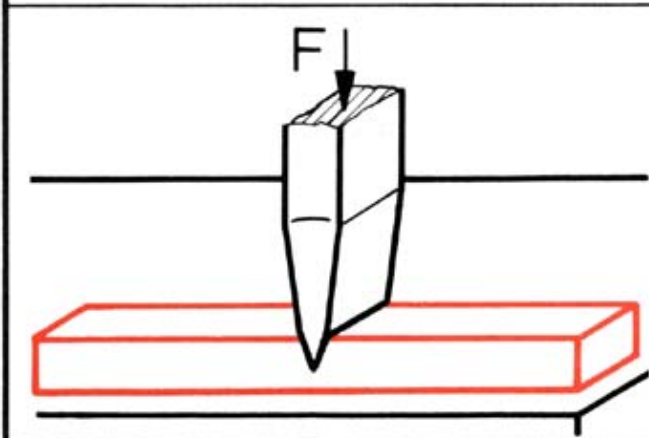
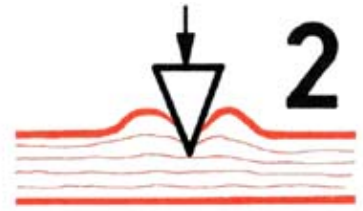
$$F_1 = F_2$$

$$\sphericalangle 60^\circ: F_R = F_1 = F_2$$

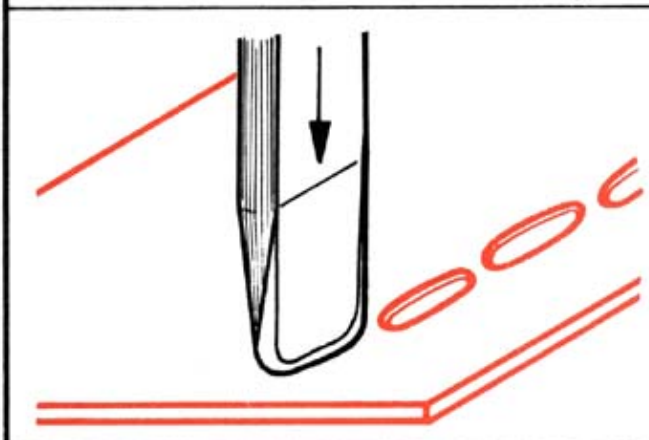


1.5

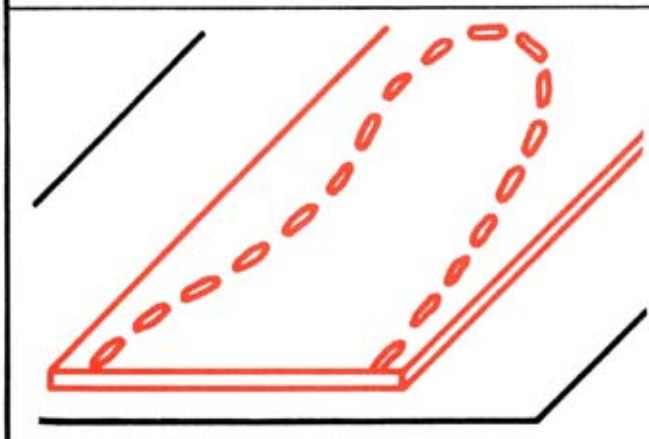
$$F_1 = F_2 < F_R$$



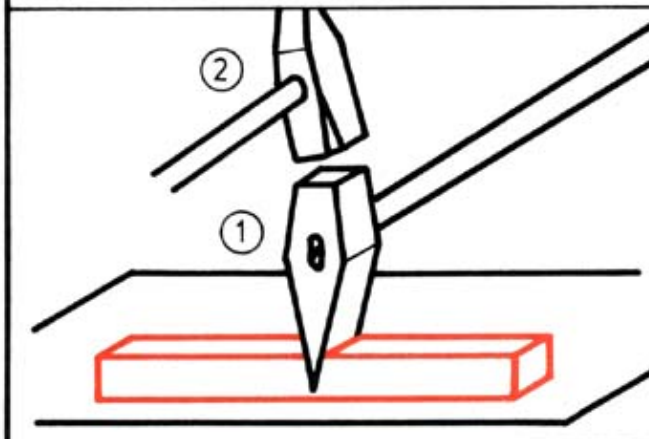
2.1



2.2



2.3



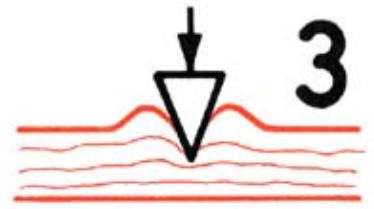
2.4

- ①
- ②



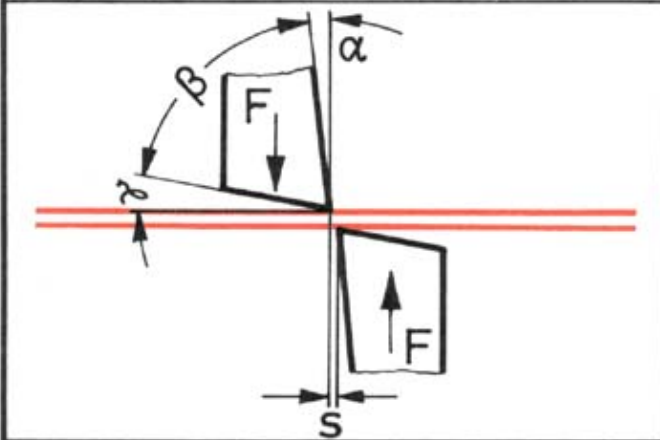
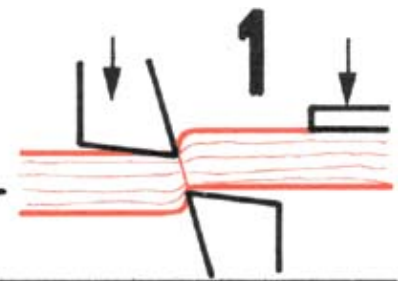
2.5

- ①
- ②



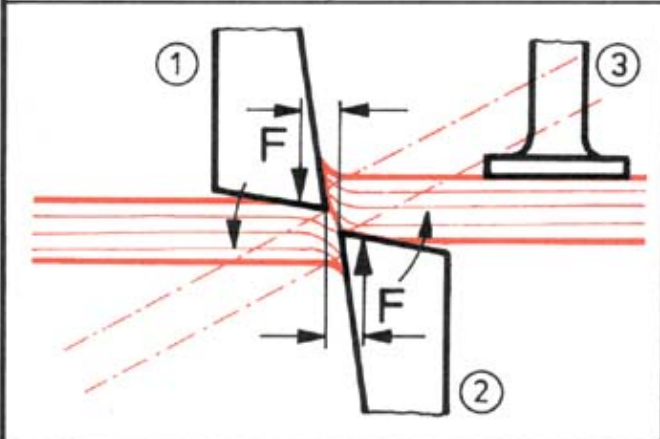
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	<p style="text-align: right;">3.2</p> <p style="text-align: center;">$F \cdot S = F \cdot S$</p>
	<p style="text-align: right;">3.3</p>
	<p style="text-align: right;">3.4</p> <p>①</p> <p>②</p>
	<p style="text-align: right;">3.5</p> <p>①</p>

4. Shearing – Scheren



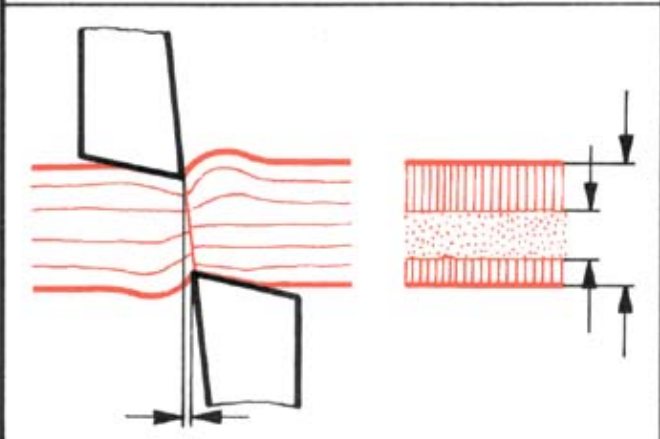
_____ 1.1

$\sphericalangle \alpha = 2 \dots 4^\circ =$
 $\sphericalangle \beta = 75 \dots 82^\circ =$
 $\sphericalangle \gamma = 5 \dots 13^\circ =$

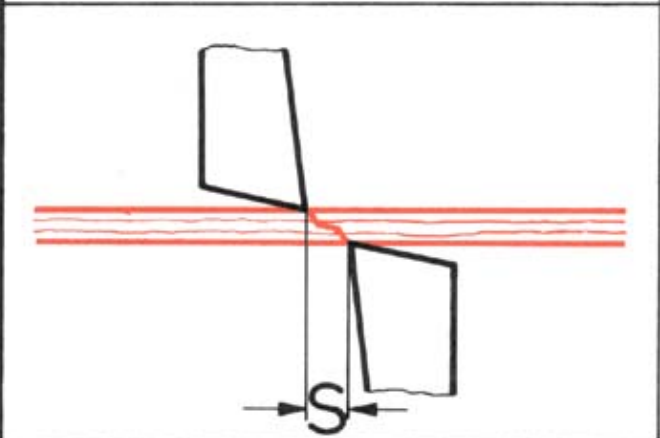


_____ 1.2

①
 ②
 ③



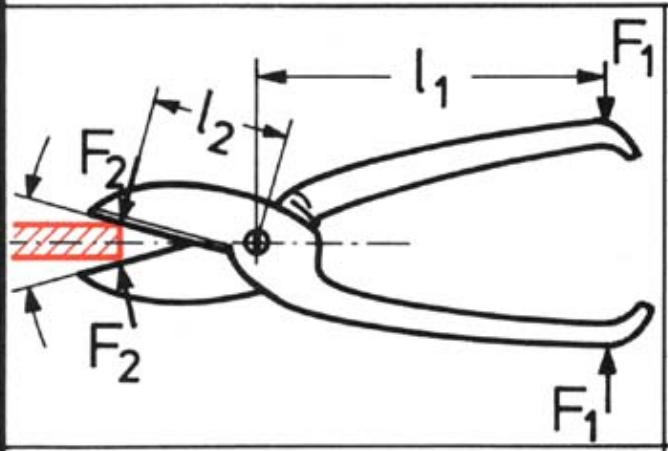
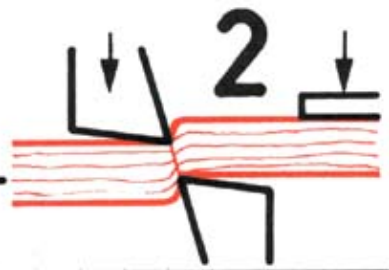
_____ 1.3



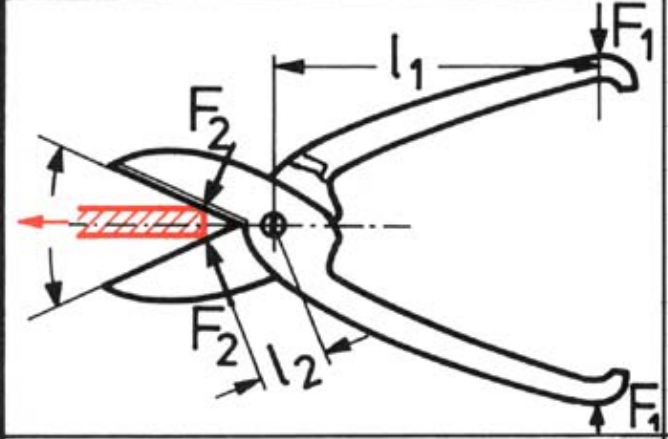
_____ 1.4



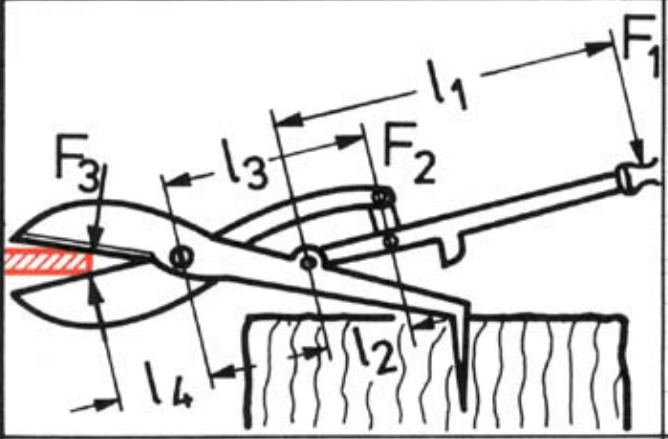
_____ 1.5



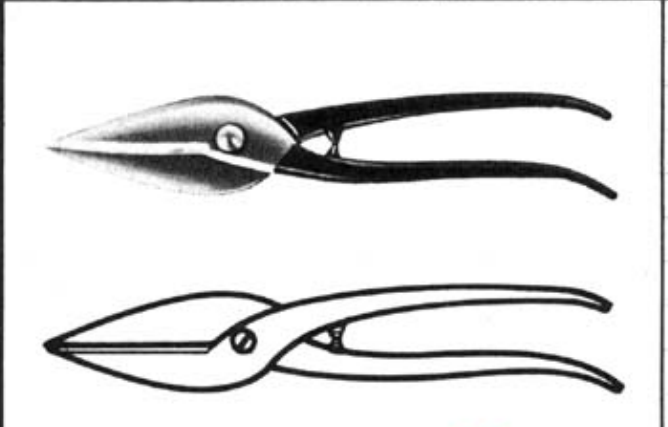
2.1



2.2



2.3



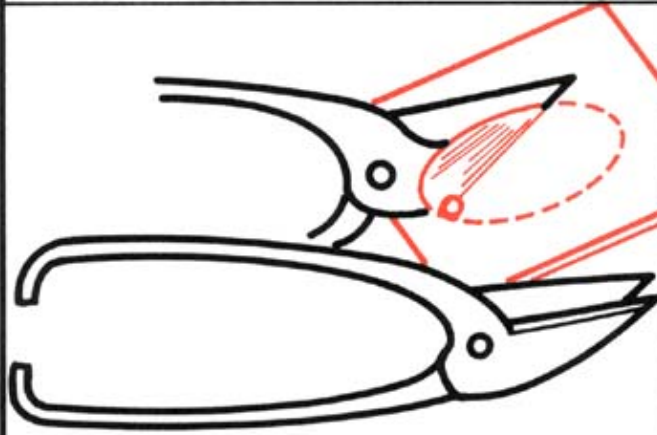
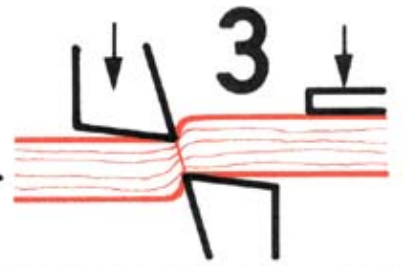
2.4

①

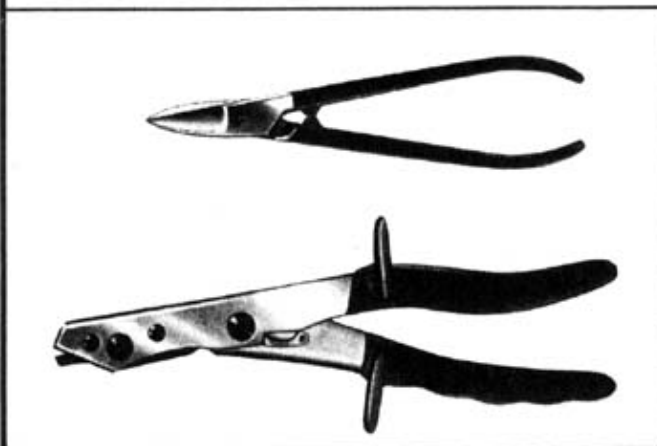
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2.5



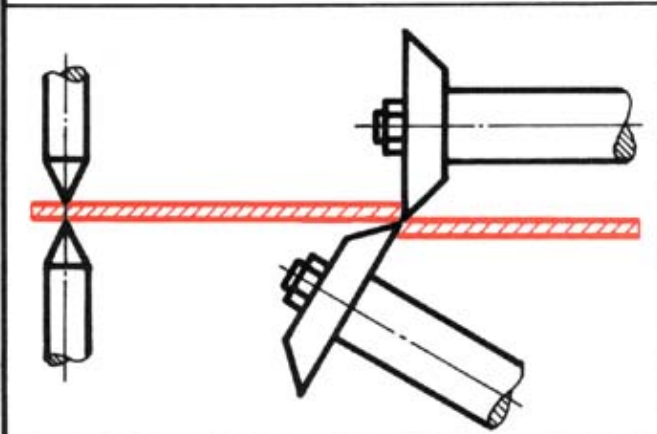
3.1



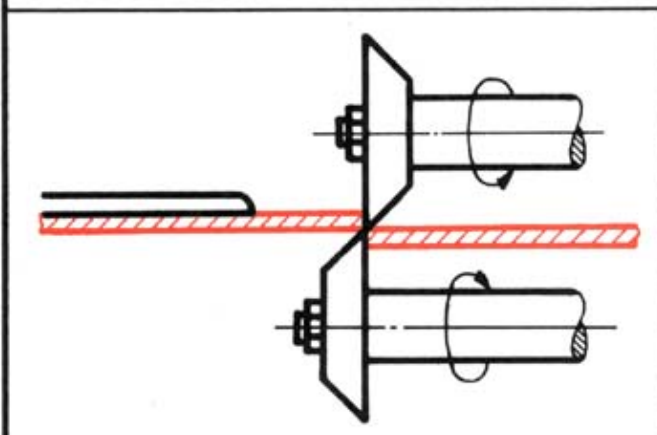
3.2

①

②



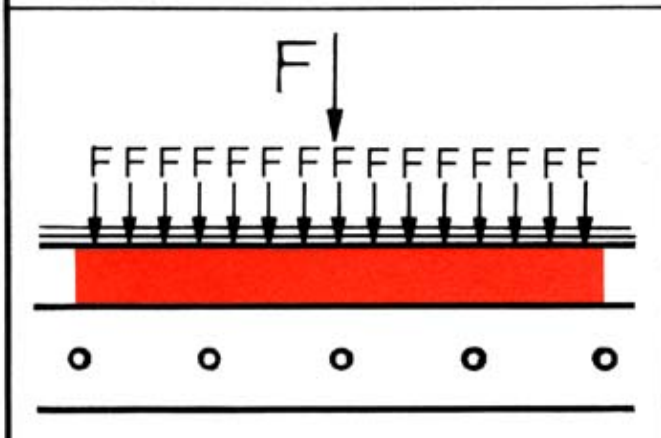
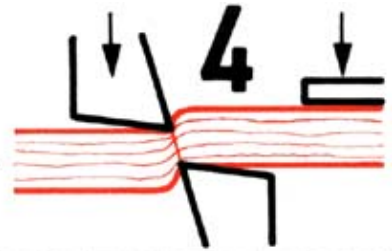
3.3



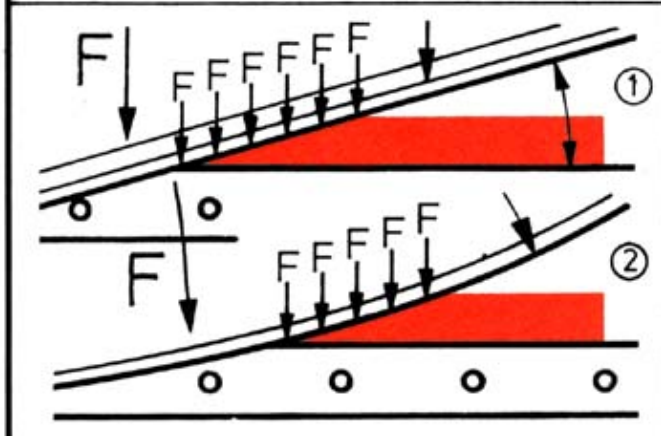
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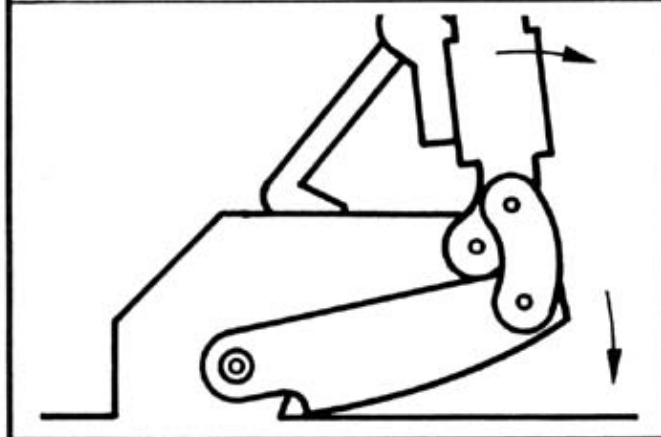
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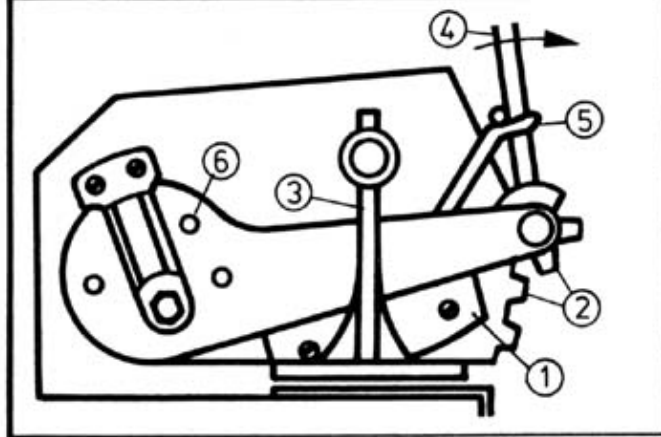
4.1



4.2



4.3



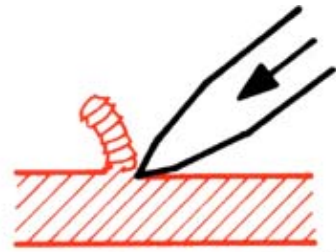
4.4

- ①
- ②
- ③
- ④
- ⑤
- ⑥

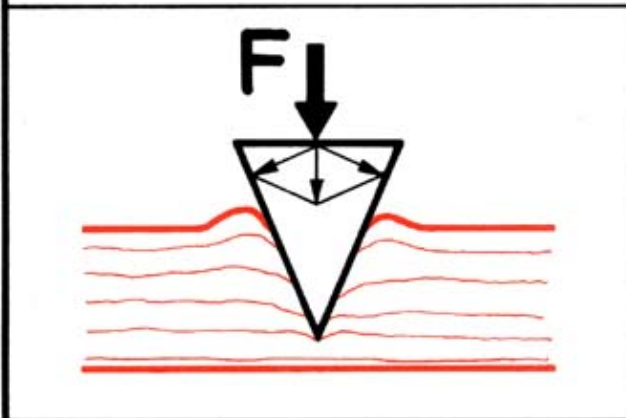


4.5

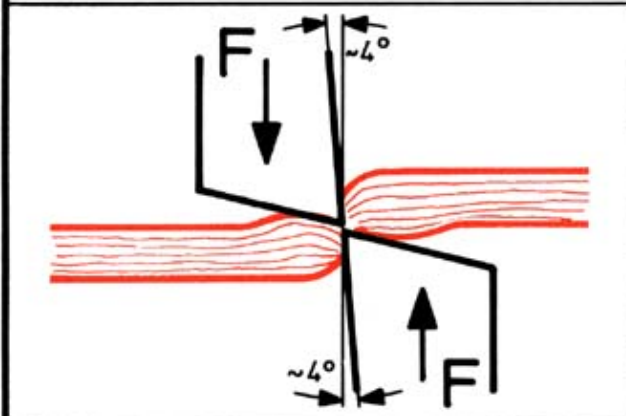
5. Angled tools/Keyed angles – Winkel am Werkzeug/Keilwinkel



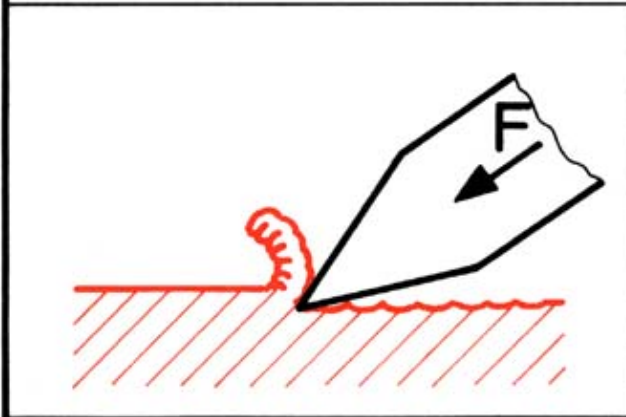
1



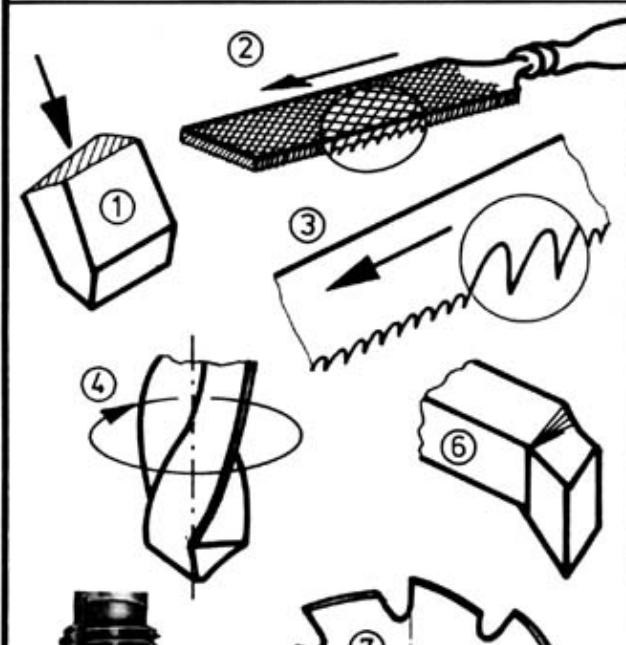
_____ 1.1



_____ 1.2

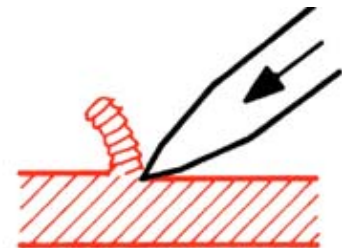


_____ 1.3

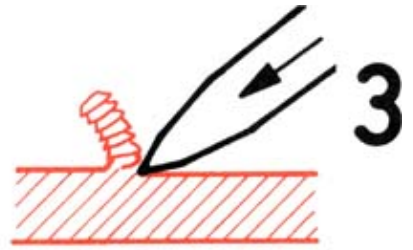


_____ 1.4

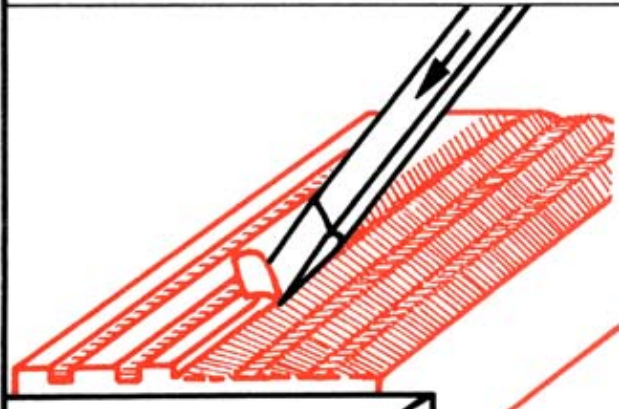
- ①
- ②
- ③
- ④
- ⑤
- ⑥
- ⑦



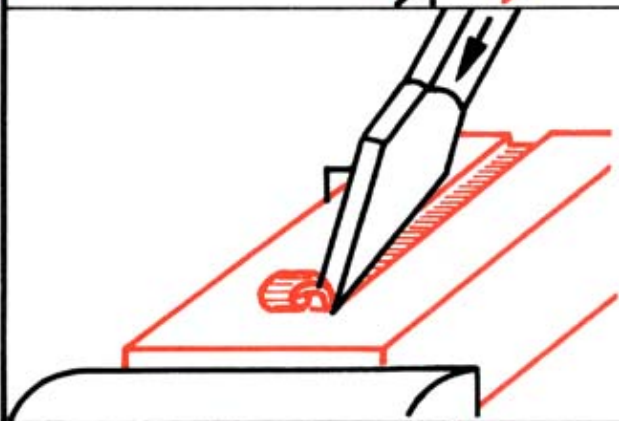
	<p>_____ 2.1</p> <p>① ② ∠α = ∠β = ∠γ =</p>
	<p>_____ 2.2</p> <p>① ② ∠α = ∠β = ∠γ =</p>
	<p>_____ 2.3</p>
	<p>_____ 2.4</p>
	<p>_____ 2.5</p>



3



3.1



3.2



3.3



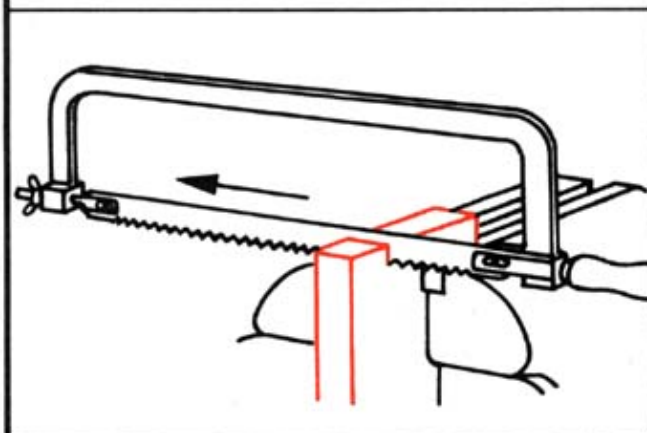
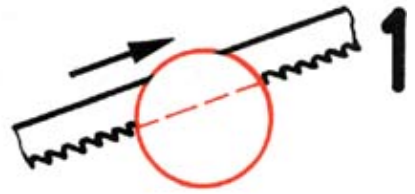
3.4



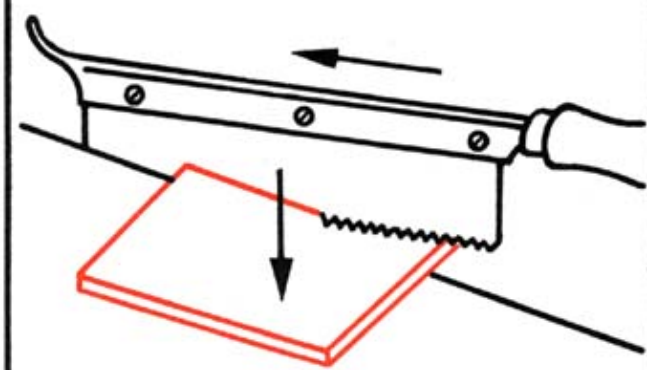
3.5



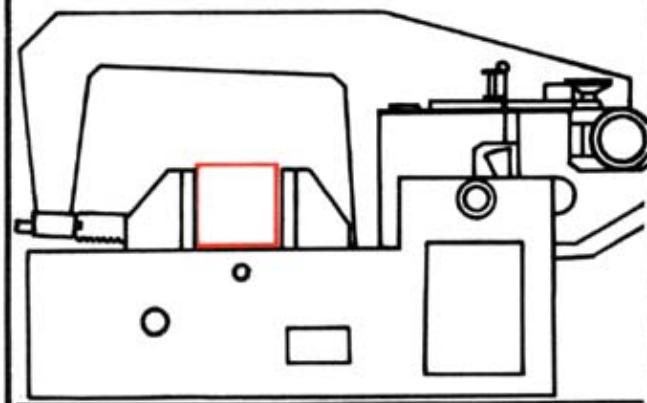
6. Sawing manual – Sägen



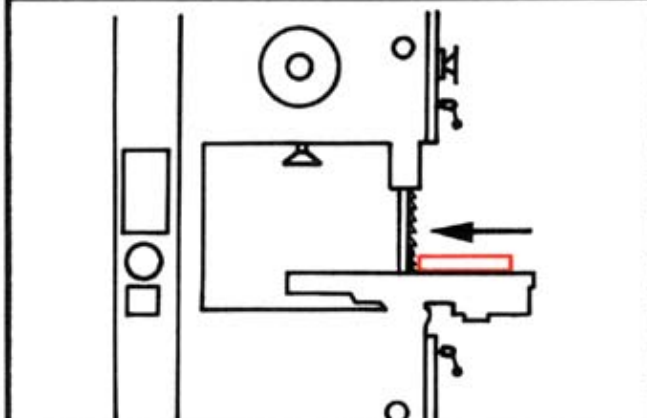
1.1



1.2



1.3

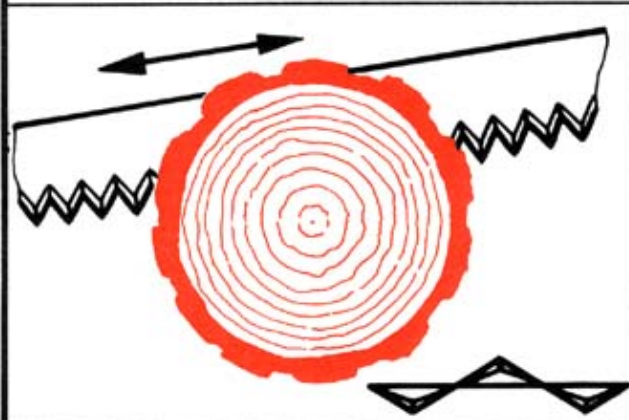
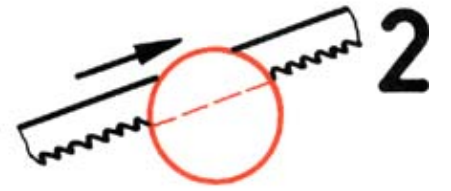


1.4



1.5

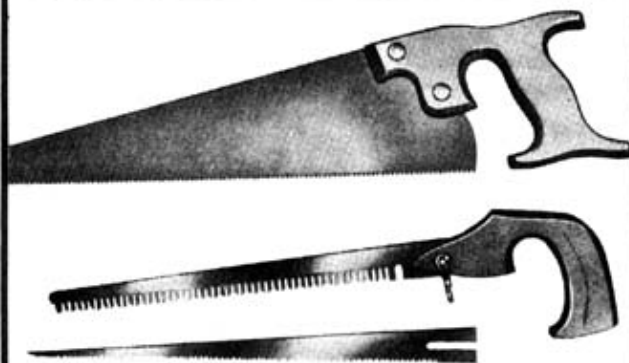




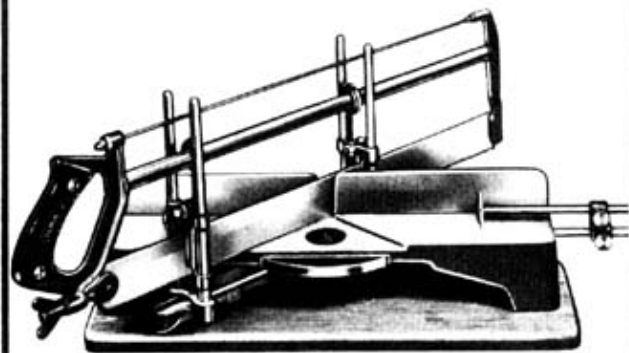
2.1



2.2



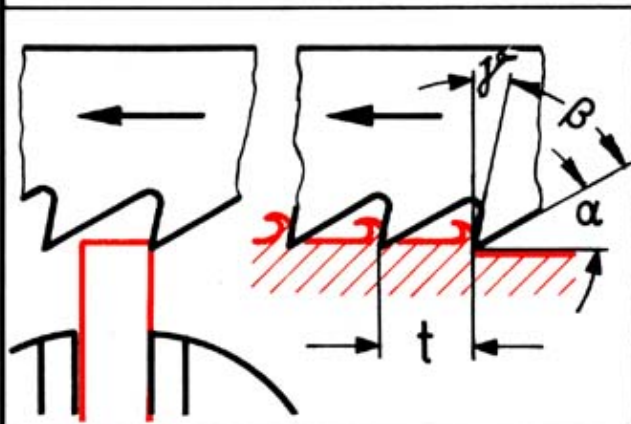
2.3



2.4

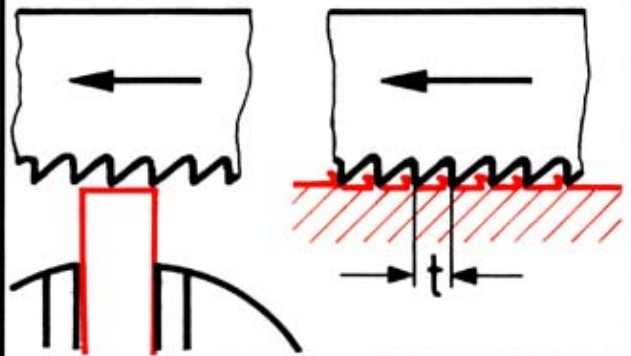


2.5



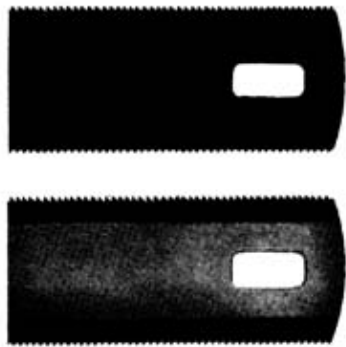
$\sphericalangle \alpha = 30^\circ$
 $\sphericalangle \beta = 50^\circ$
 $\sphericalangle \gamma = 10^\circ$

3.1

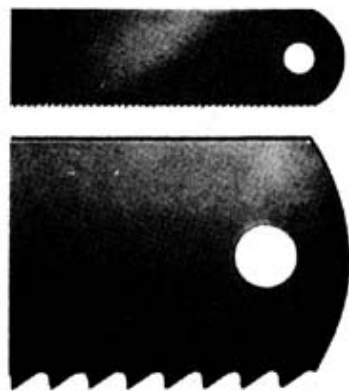


$\sphericalangle \alpha = 40^\circ$
 $\sphericalangle \beta = 50^\circ$
 $\sphericalangle \gamma = 0^\circ$

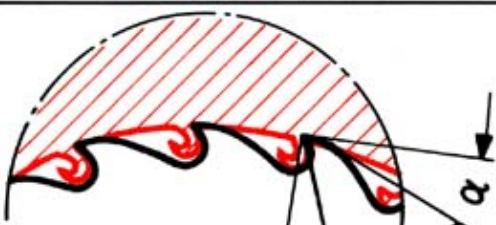
3.2



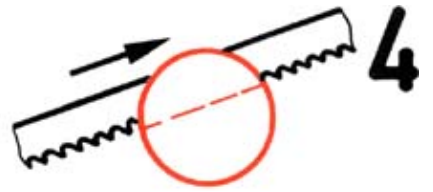
3.3



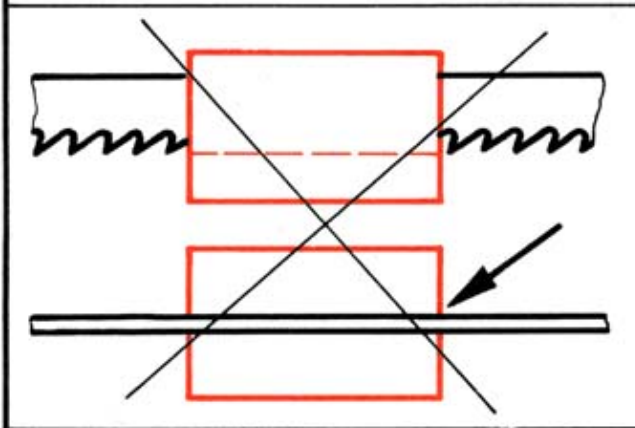
3.4



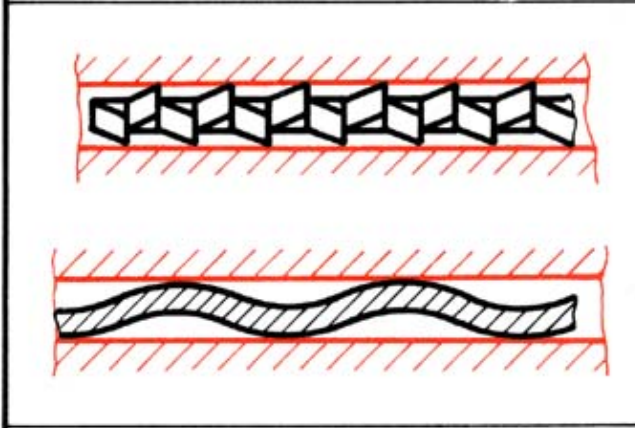
3.5



4



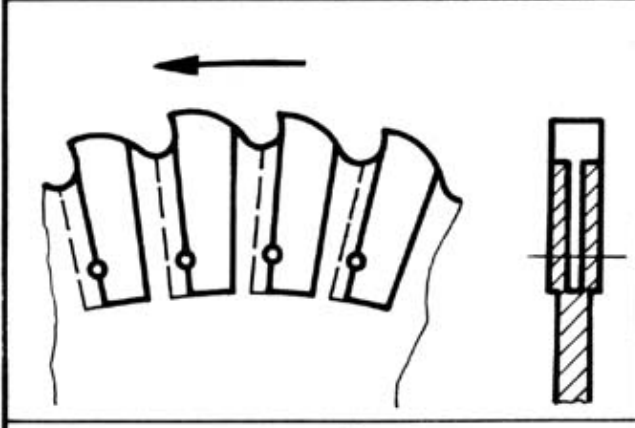
4.1



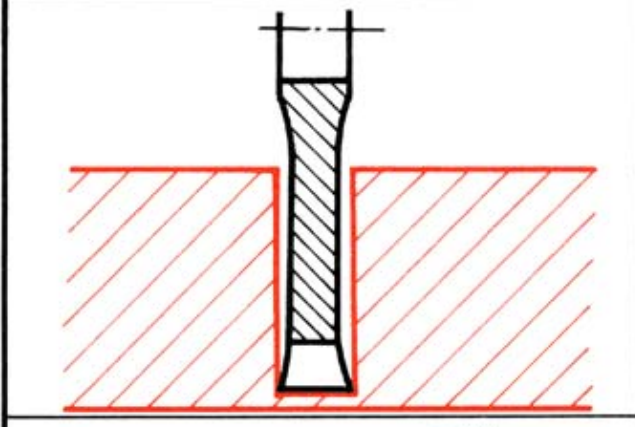
4.2

①

②



4.3



4.4



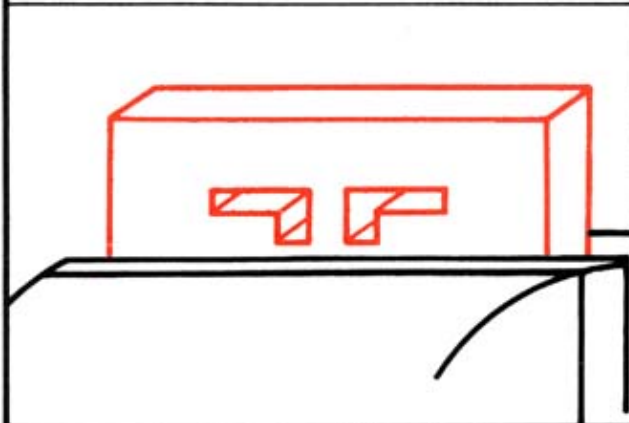
4.5

33

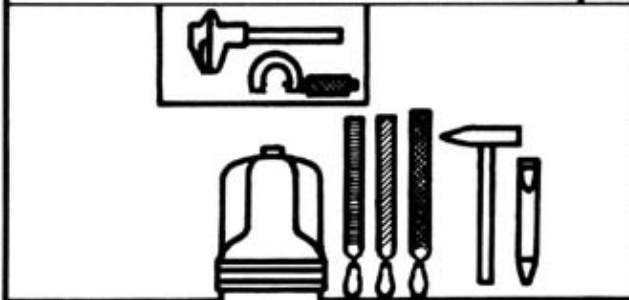
7. Filing – Feilen



1



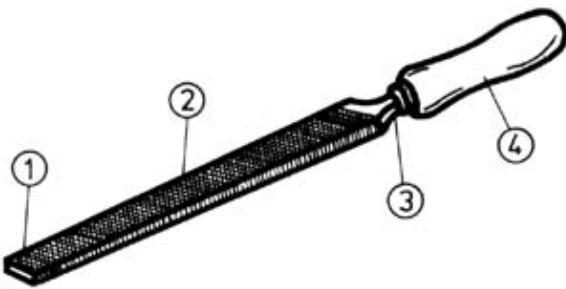
1.1



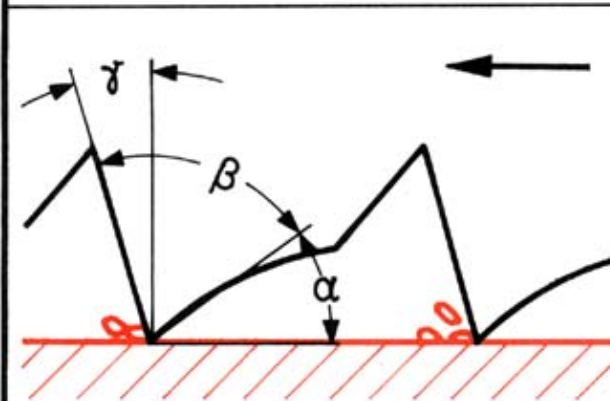
1.2



1.3

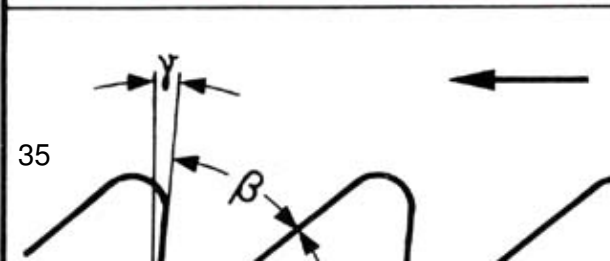


- ①
- ②
- ③
- ④



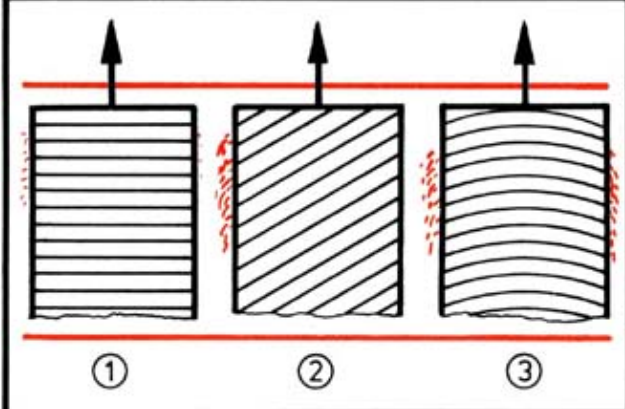
1.4

- ↔ α
- ↔ β
- ↔ γ



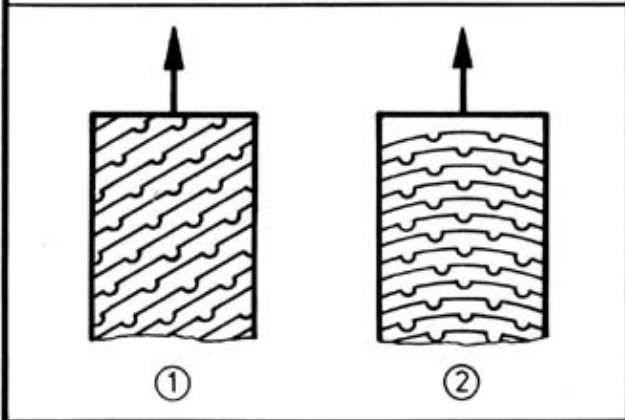
1.5

- ↔ α
- ↔ β
- ↔ γ



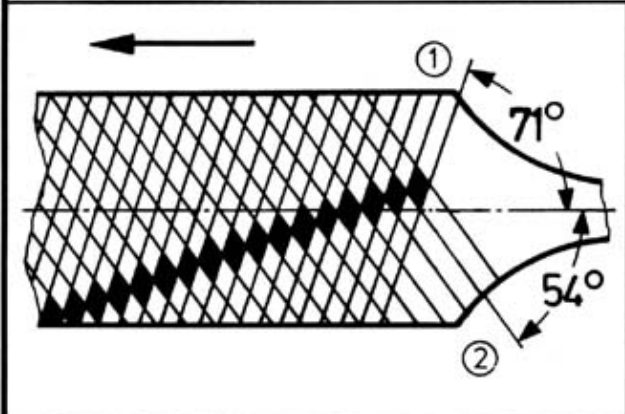
_____ 2.1

①
②
③



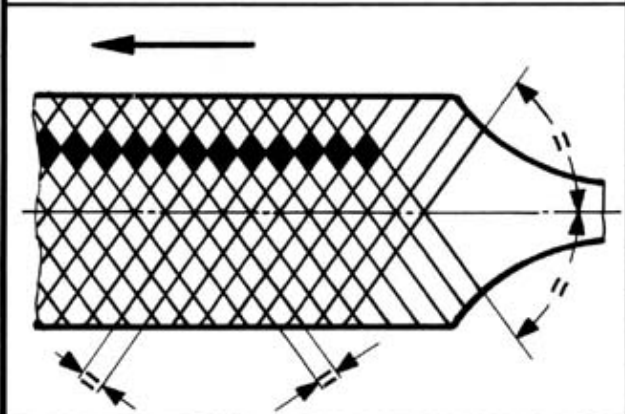
_____ 2.2

①
②

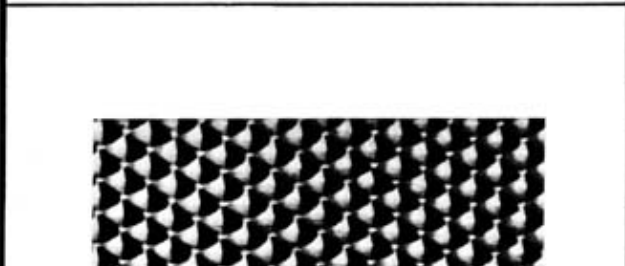


_____ 2.3

①
②

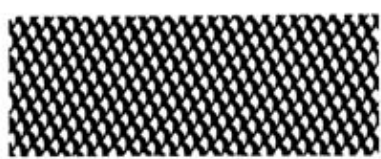
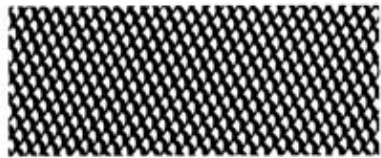
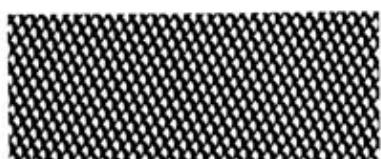
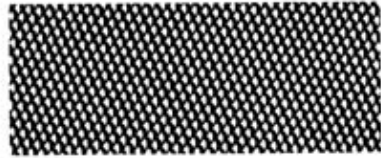

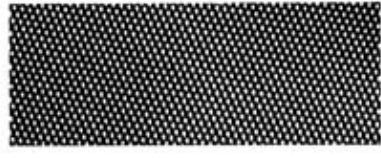
















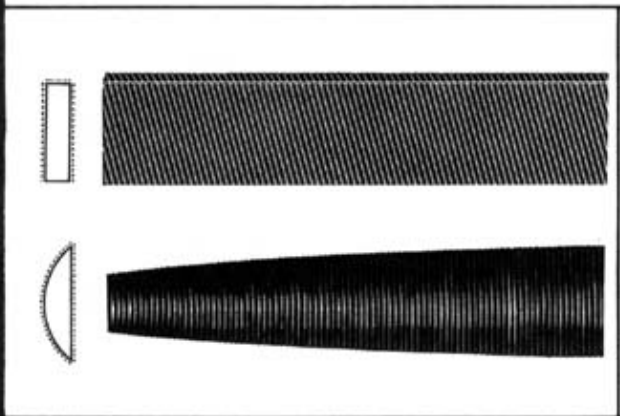
_____ 2.4



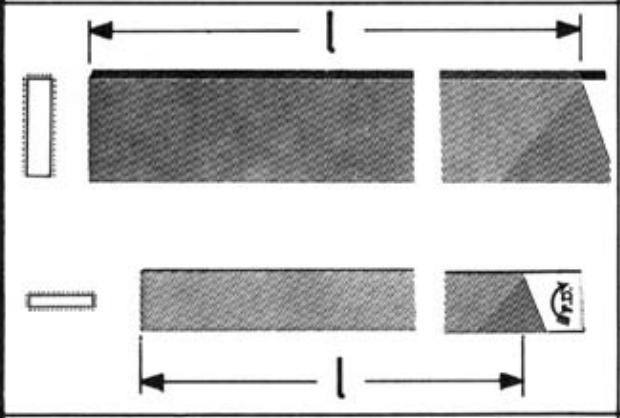
_____ 2.5



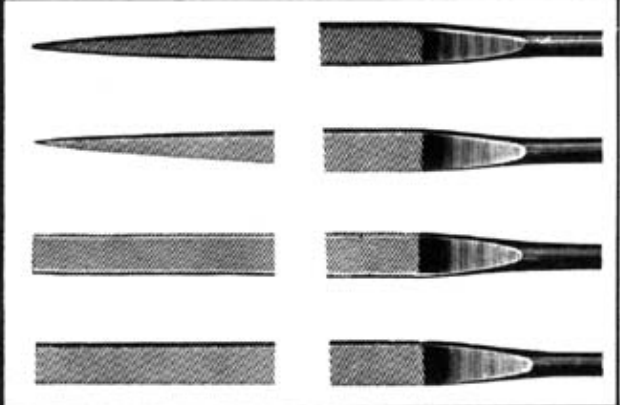
 1  2	_____ 3.1 1 _____ 2 _____
 3  4	_____ 3.2 3 _____ 4 _____
 5  6	_____ 3.3 5 _____ 6 _____
 □  341  ▽  342  □  343  ▷  344  ○  345  ▷  346  ◇  347	_____ 3.4 341 _____ 342 _____ 343 _____ 344 _____ 345 _____ 346 _____ 347 _____



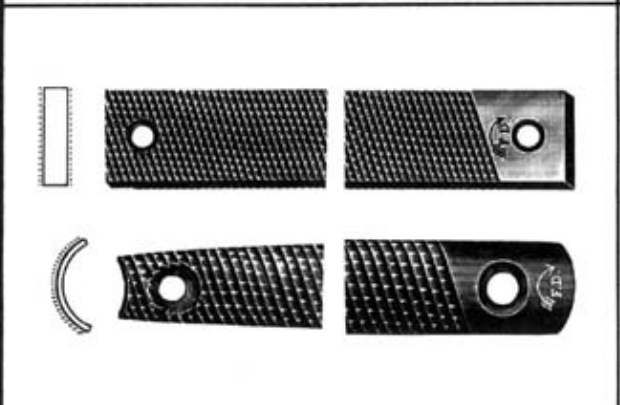
_____ 4.1



_____ 4.2



_____ 4.3



_____ 4.4

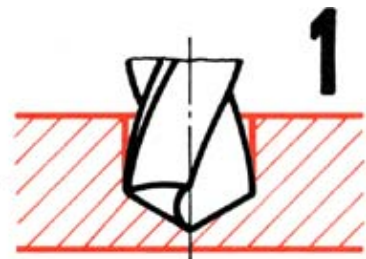


_____ 4.5

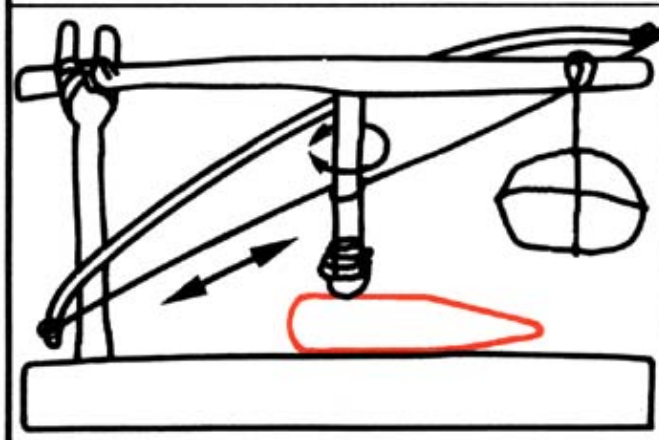


	<p>5.1</p> <hr/>
	<p>5.2</p> <hr/>
	<p>5.3</p> <hr/>
	<p>5.4</p> <hr/>
<p>39</p>	<p>5.5</p> <hr/>

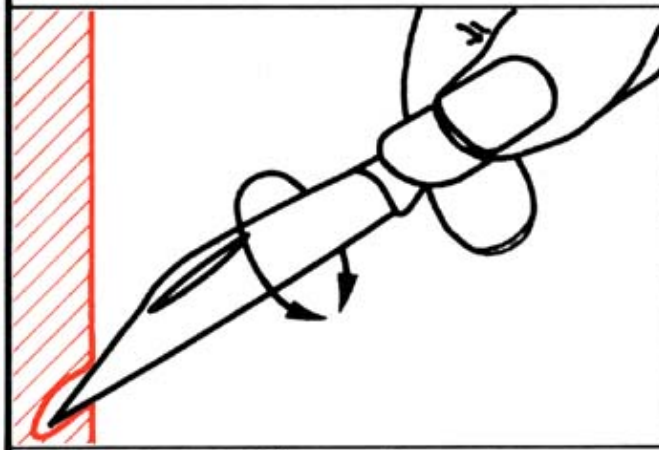
8. Drilling, Counterboring, Countersinking – Bohren, Reiben



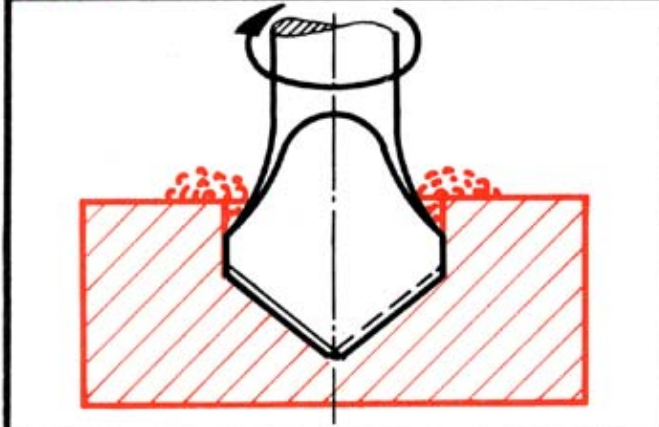
1



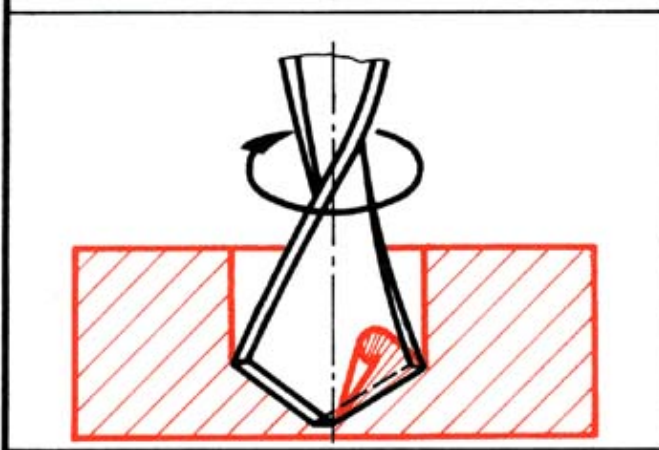
1.1



1.2



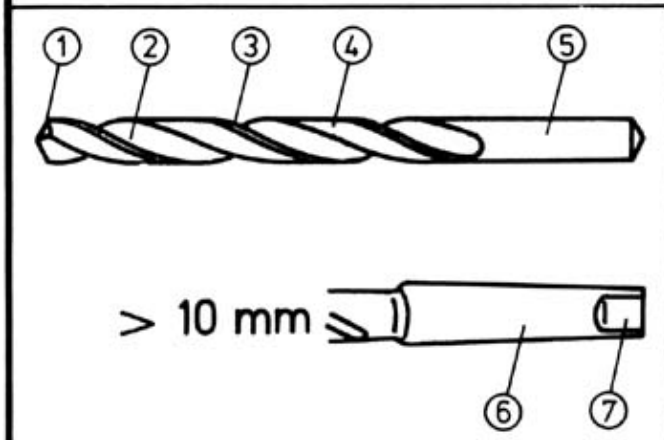
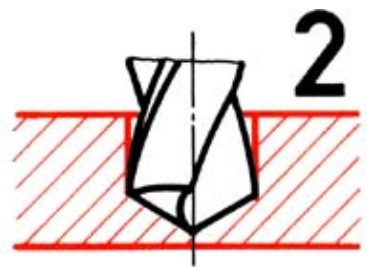
1.3



1.4

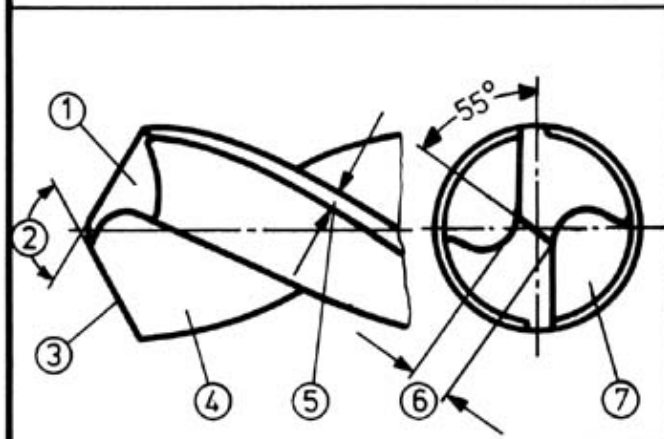


1.5



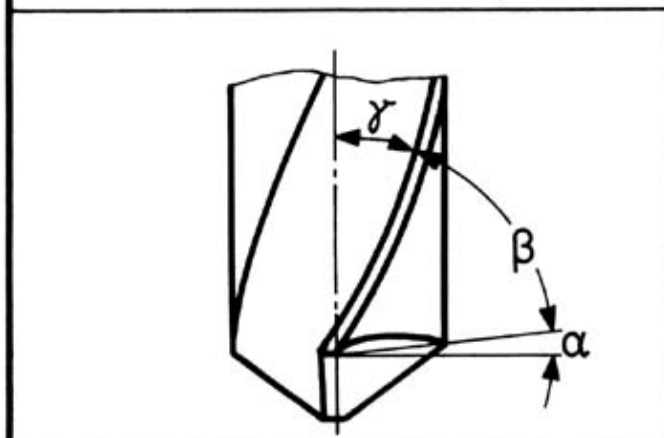
2.1

① _____
 ② _____
 ③ _____
 ④ _____
 ⑤ _____
 ⑥ _____
 ⑦ _____



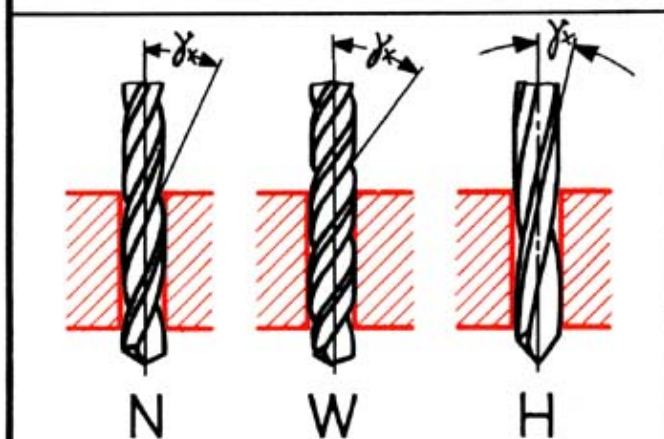
2.2

① _____
 ② $\sphericalangle \sigma$
 ③ _____
 ④ _____
 ⑤ _____
 ⑥ _____
 ⑦ _____



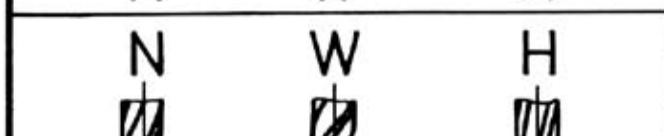
2.3

$\sphericalangle \alpha =$ _____
 $\sphericalangle \beta =$ _____
 $\sphericalangle \gamma =$ _____



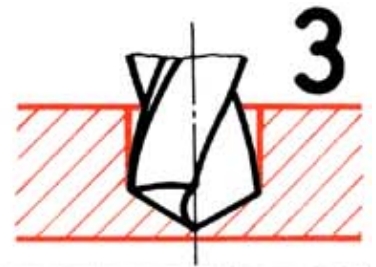
2.4

N - $\sphericalangle \gamma$ _____
 W - $\sphericalangle \gamma$ _____
 H - $\sphericalangle \gamma$ _____

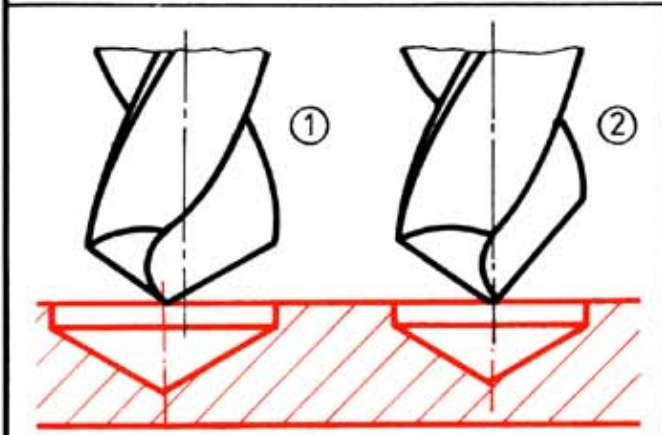
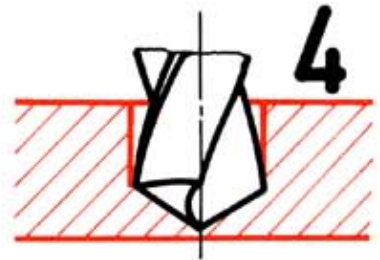


2.5

$\sphericalangle \sigma$ _____



	<p>_____ 3.1</p> <p>①</p> <p>②</p>
	<p>_____ 3.2</p> <p>①</p> <p>②</p> <p>⚠</p>
	<p>_____ 3.3</p> <p>⚠</p>
	<p>_____ 3.4</p> <p>①</p> <p>②</p> <p>③</p>
	<p>_____ 3.5</p> <p>①</p> <p>②</p> <p>③</p>

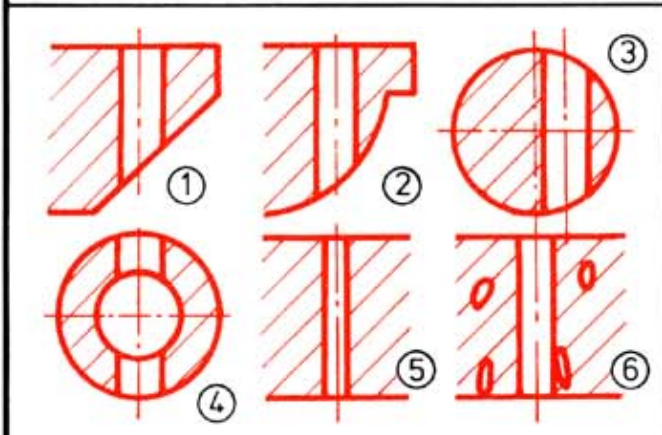


_____ 4.1

①

②

① + ② =



_____ 4.2

⚠

①

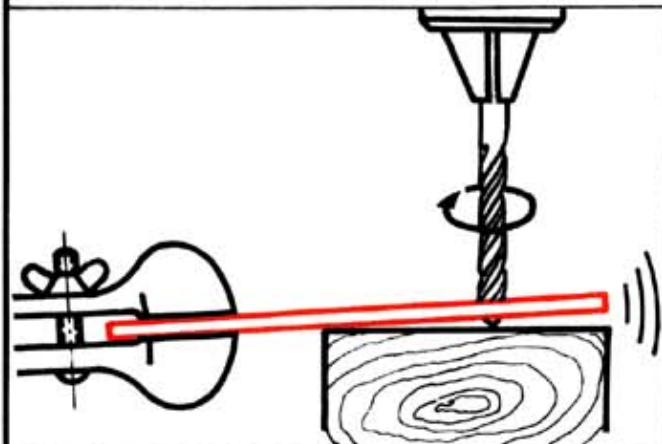
②

③

④

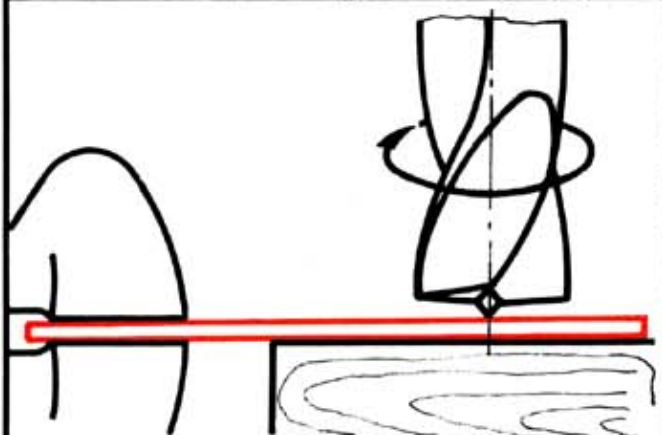
⑤

⑥



_____ 4.3

⚠



_____ 4.4

⚠



_____ 4.5



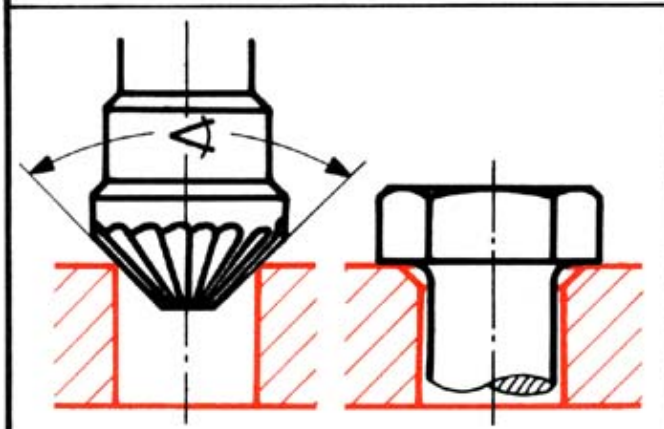
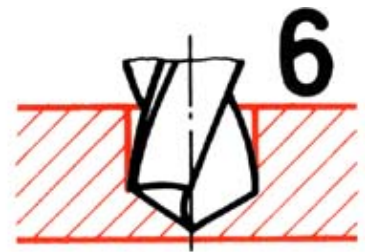
	<p>_____ 5.1</p> <p>① _____</p> <p>② _____</p>
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	<p>_____ 5.2</p>
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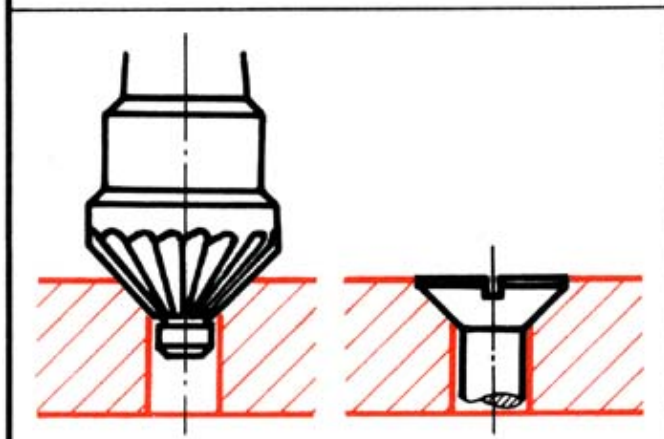
	<p>_____ 5.3</p> <p>① _____</p> <p>② _____</p>
--	--

	<p>_____ 5.4</p> <p>① _____</p> <p>② _____</p> <p>③ _____</p>
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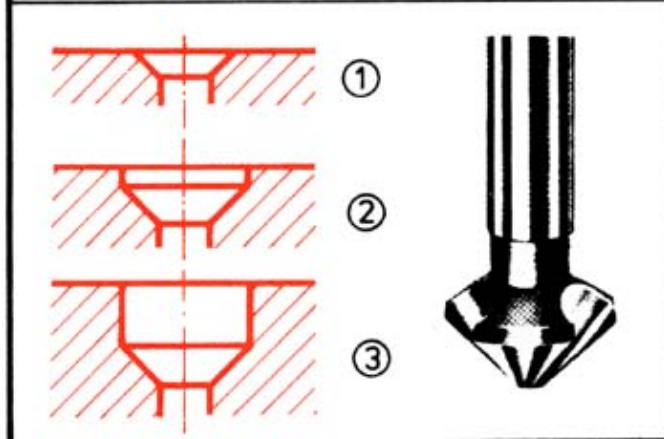
	<p>_____ 5.5</p>
--	------------------



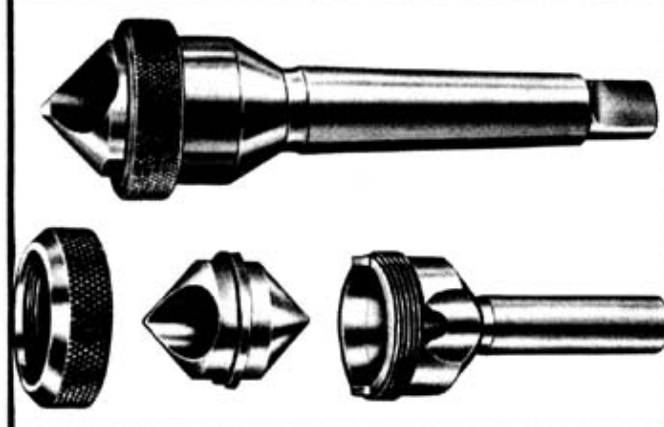
_____ 6.1
 $\alpha = 60^\circ, 75^\circ, 90^\circ, 120^\circ$



_____ 6.2



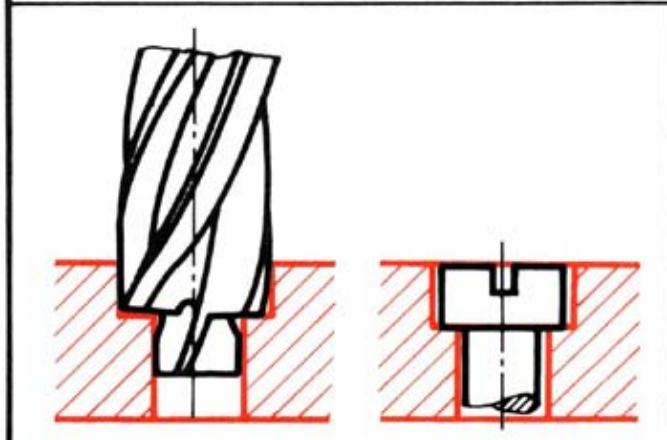
_____ 6.3
 ①
 ②
 ③



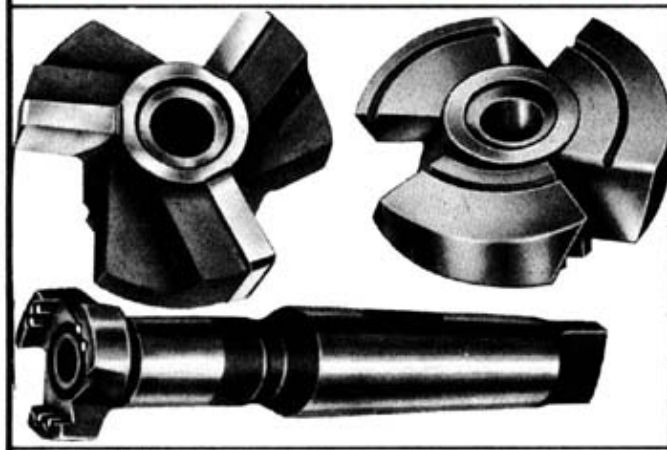
_____ 6.4



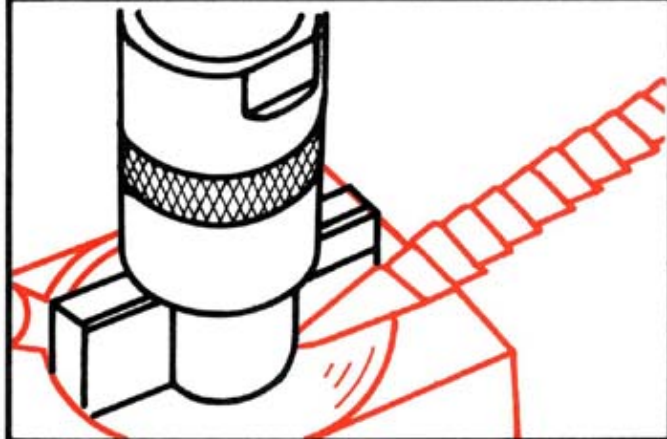
_____ 6.5



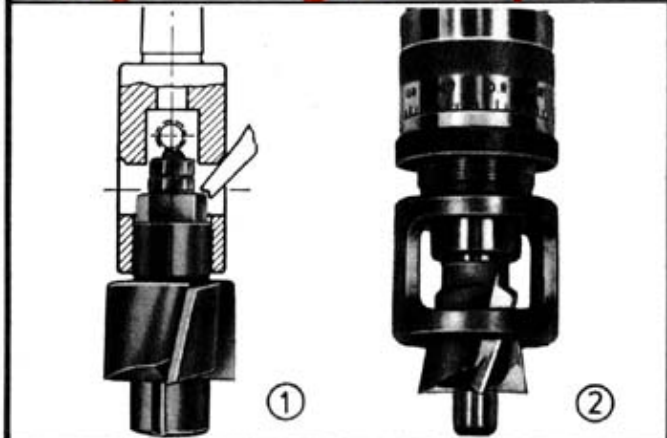
7.1



7.2



7.3



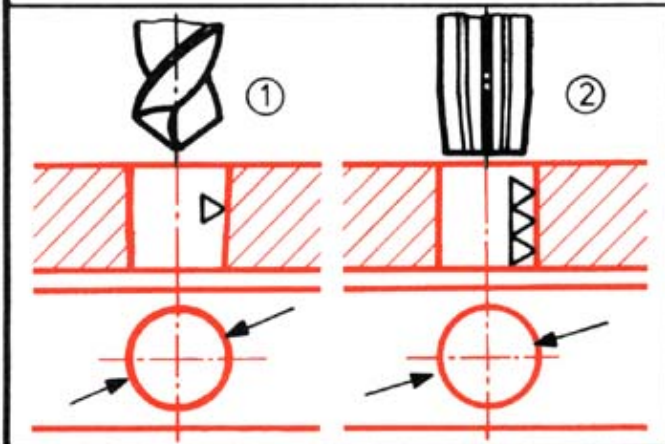
7.4

①

②



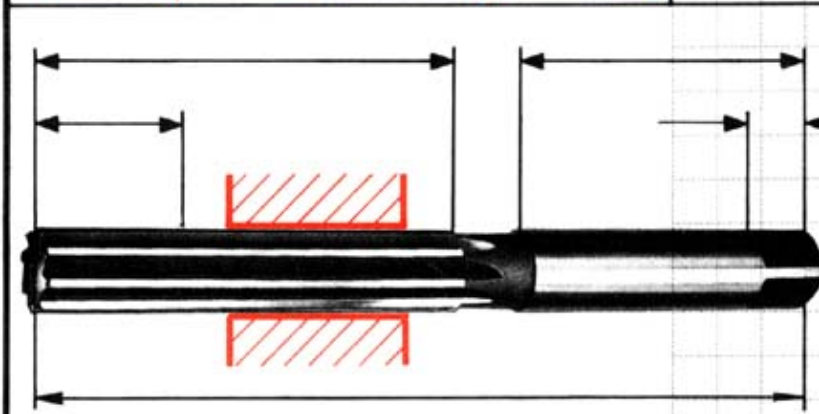
7.5



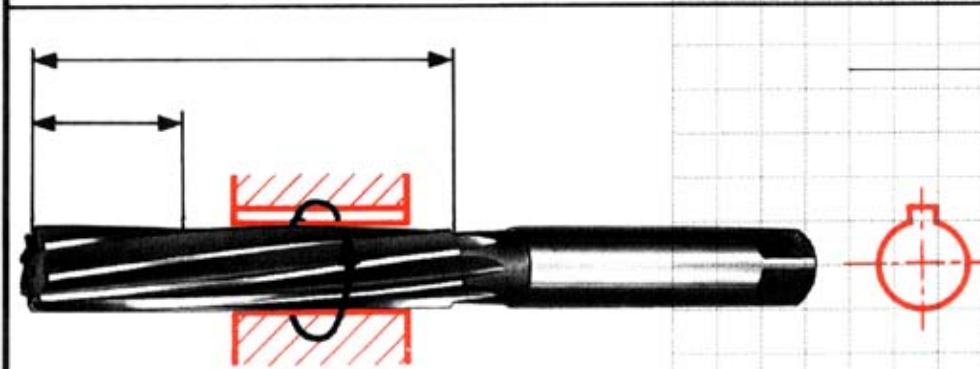
_____ 8.1

①

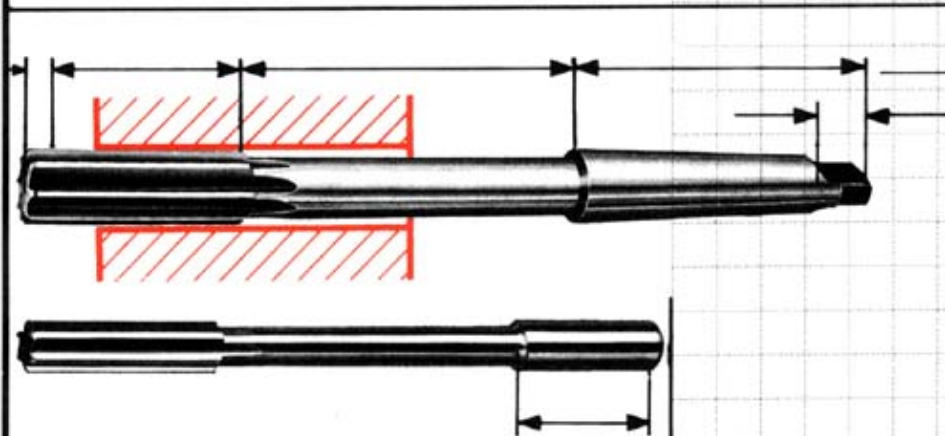
②



8.2



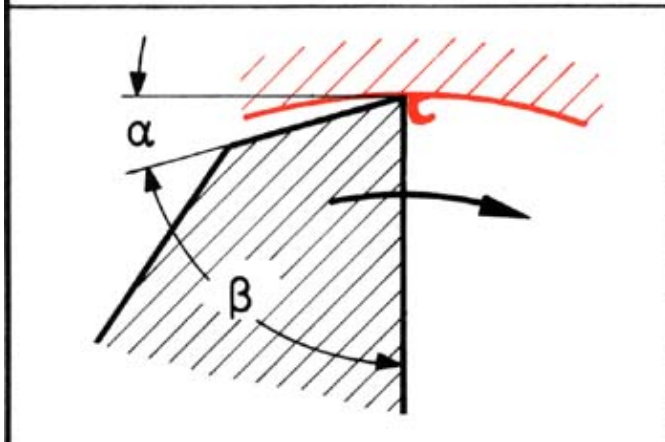
8.3



8.4

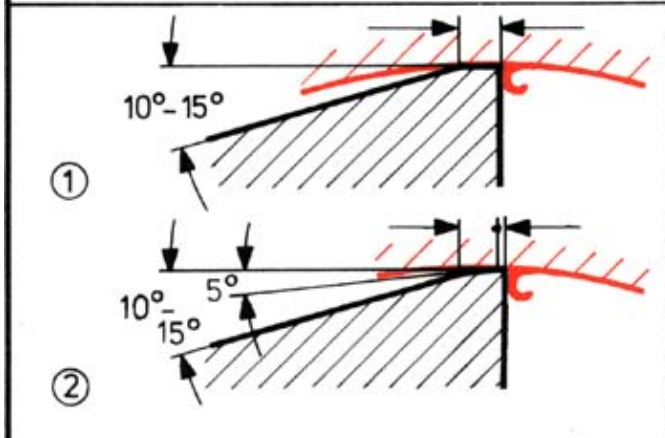


8.5



9.1

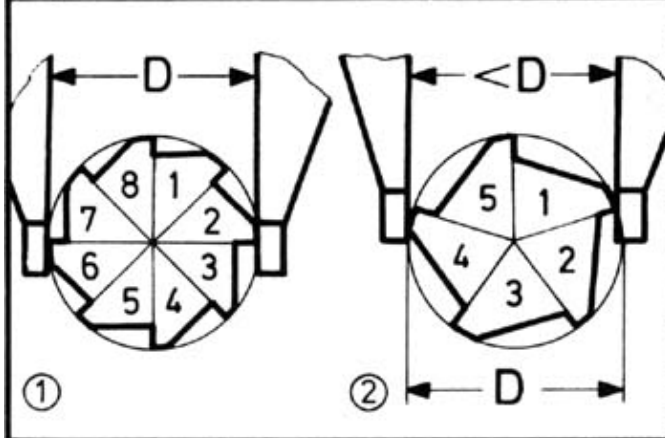
- ▷ α =
- ▷ β =
- ▷ γ =



9.2

①

②

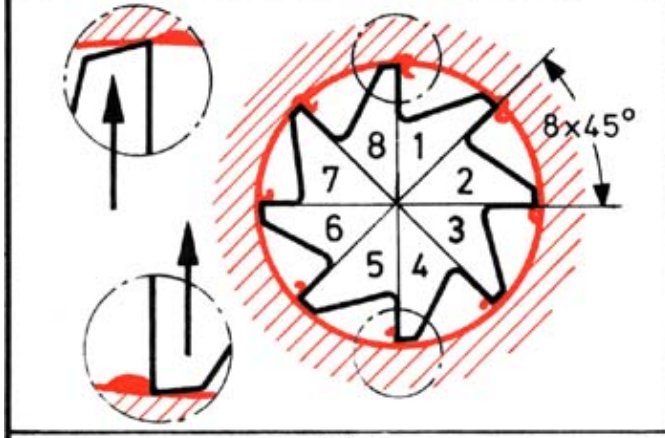


9.3



①

②



9.4

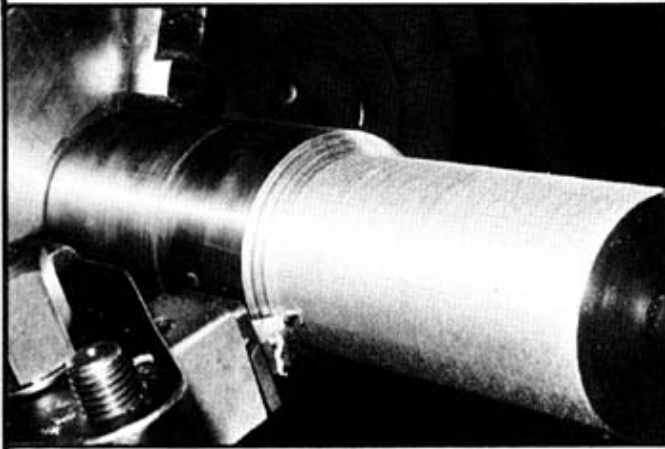


9.5

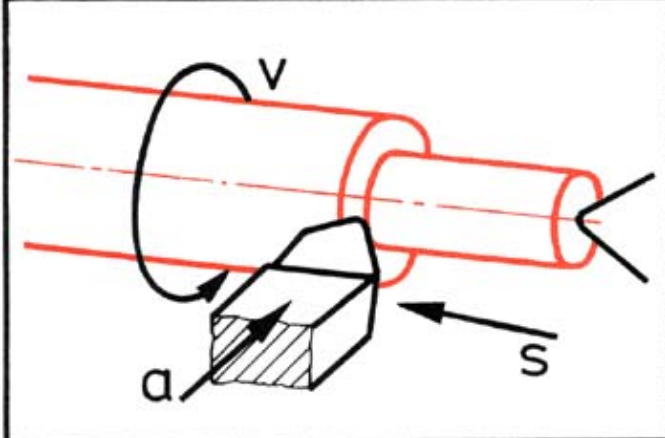
10

 	<p>_____ 10.1</p>
	<p>_____ 10.2</p>
	<p>_____ 10.31</p>
<p>① ②</p>	<p>_____ 10.32</p> <p>①</p> <p>②</p>
 	<p>_____ 10.4</p> <p>①</p> <p>②</p>
	<p>_____ 10.5</p> <p>①</p>

9. Turning – Drehen

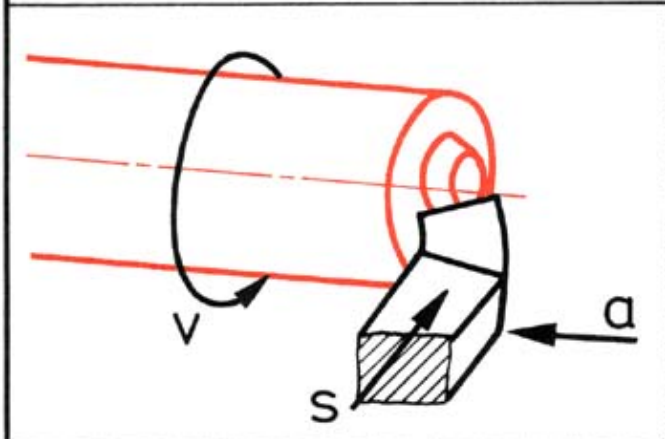


1.1



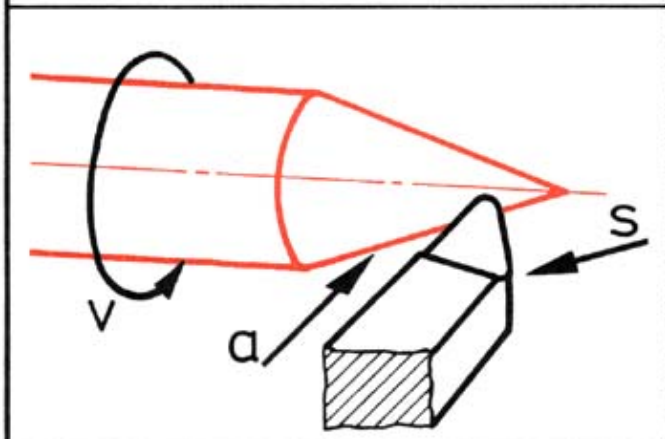
1.2

v -
a -
s -



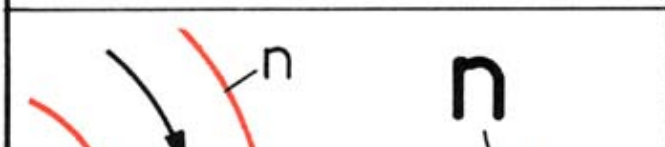
1.3

v -
a -
s -

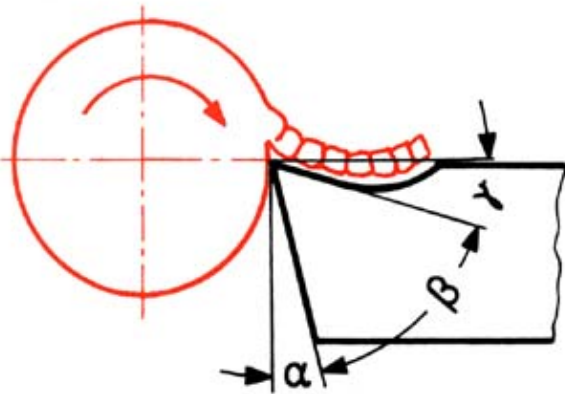
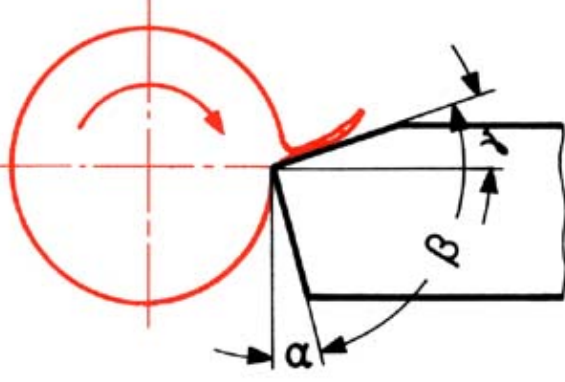
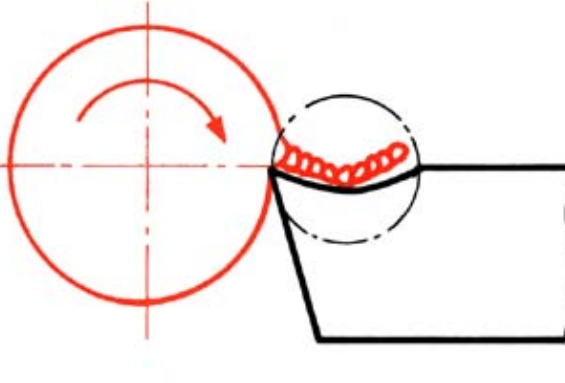
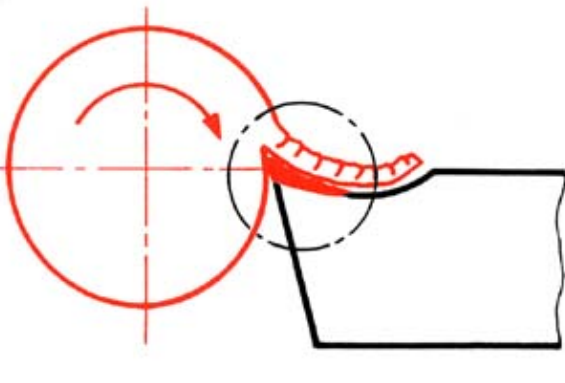



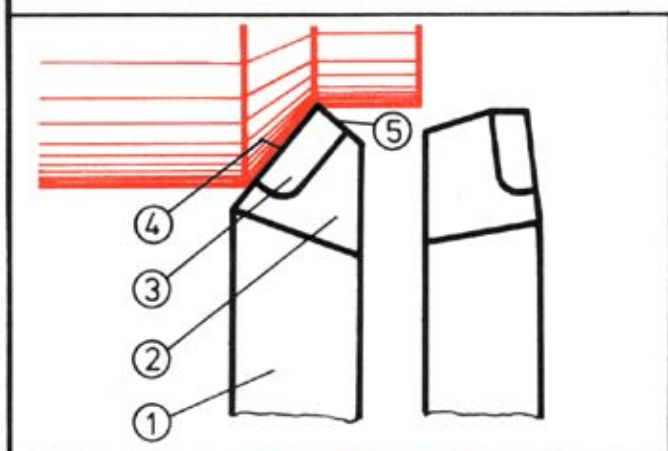
1.4

v -
a -
s -



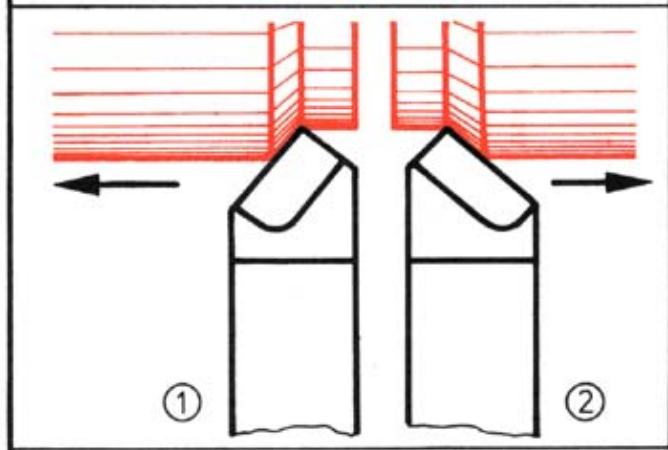
1.5

	<p style="text-align: right;">2.1</p> <hr style="width: 100%;"/> <p> $\Delta \alpha =$ $\Delta \beta =$ $\Delta \gamma =$ </p>
	<p style="text-align: right;">2.2</p> <hr style="width: 100%;"/>
	<p style="text-align: right;">2.3</p> <hr style="width: 100%;"/>
	<p style="text-align: right;">2.4</p> <hr style="width: 100%;"/>
<p>53</p> 	<p style="text-align: right;">2.5</p> <hr style="width: 100%;"/> <p style="text-align: center;">① ①</p>



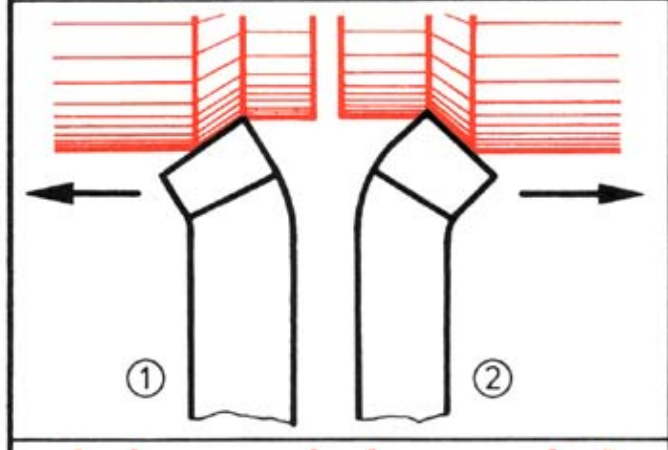
3.1

①
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③
④
⑤



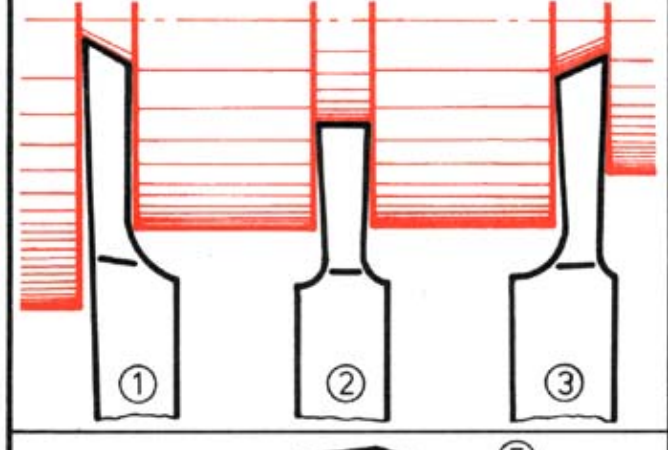
3.2

①
②



3.3

①
②



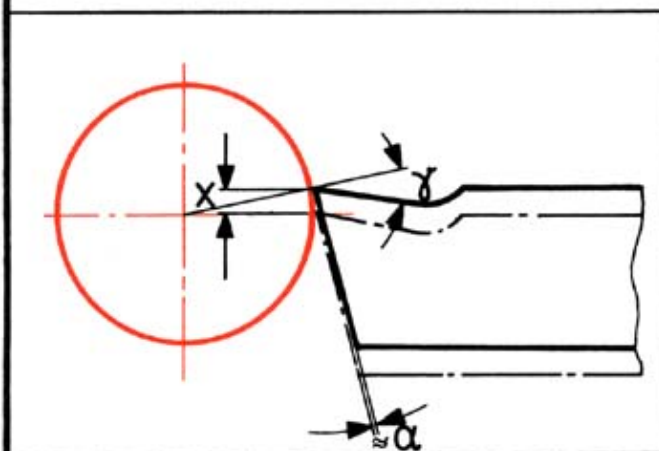
3.4

①
②
③



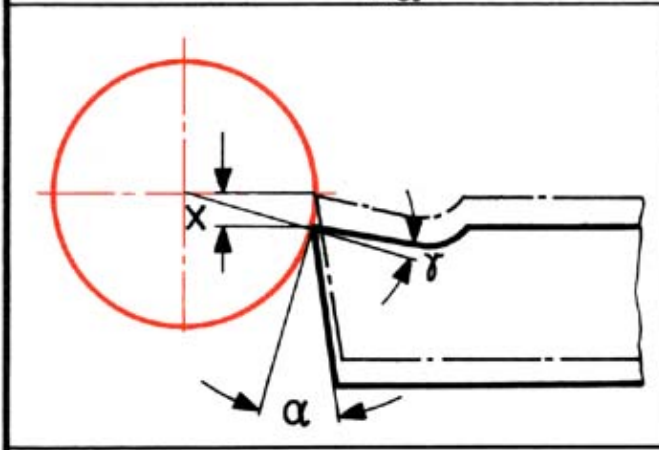
3.5

①



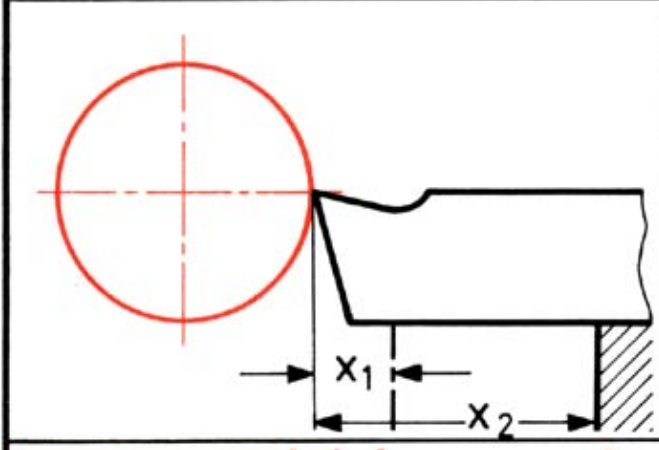
_____ 4.1

$\sphericalangle \alpha =$
 $\sphericalangle \beta =$
 $\sphericalangle \gamma =$



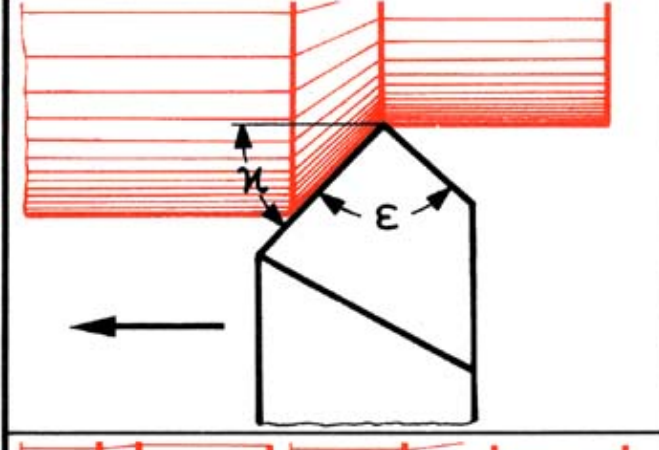
_____ 4.2

$\sphericalangle \alpha =$
 $\sphericalangle \beta =$
 $\sphericalangle \gamma =$



_____ 4.3

$x_1 =$
 $x_2 =$

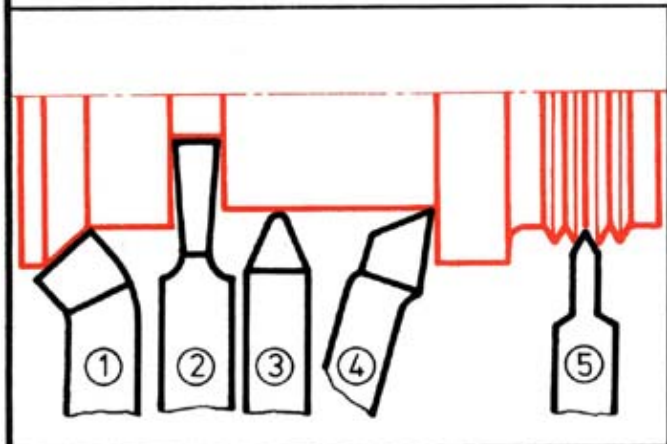


_____ 4.4

$\epsilon =$
 $\chi =$

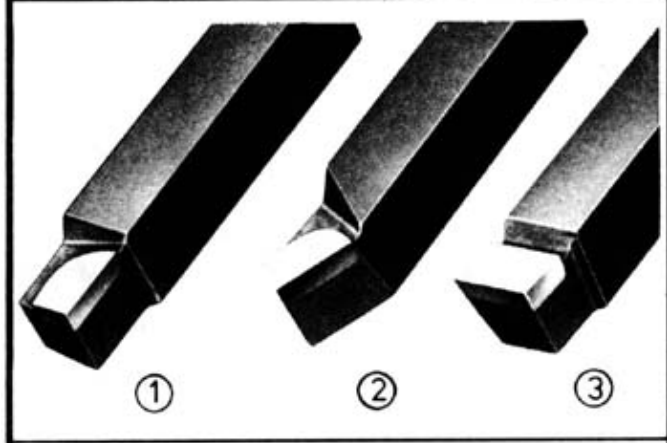


_____ 4.5



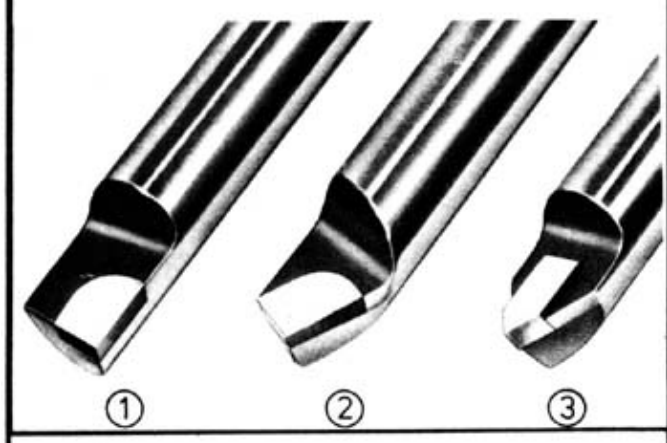
5.1

①
②
③
④
⑤



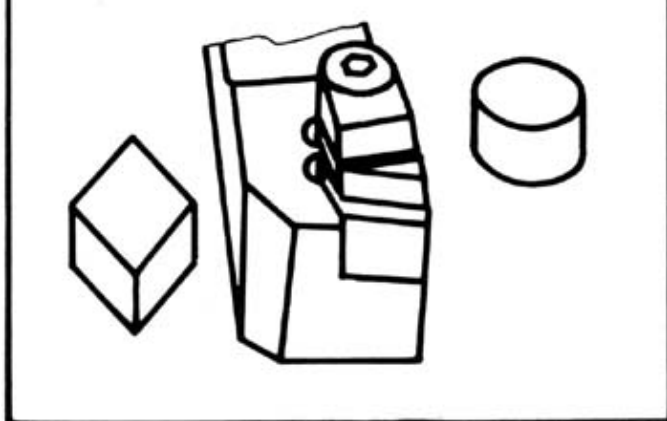
5.2

①
②
③



5.3


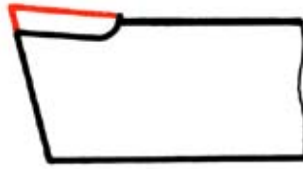




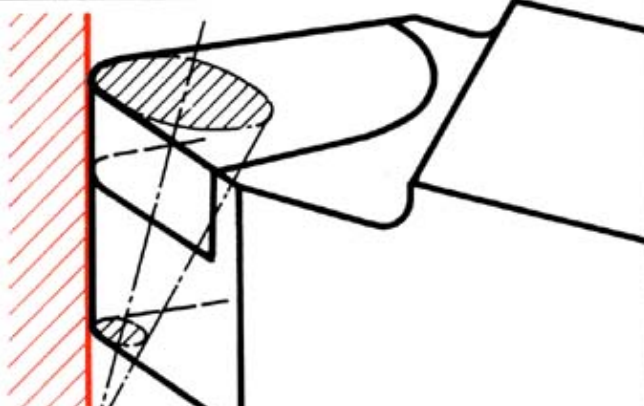

①
②
③



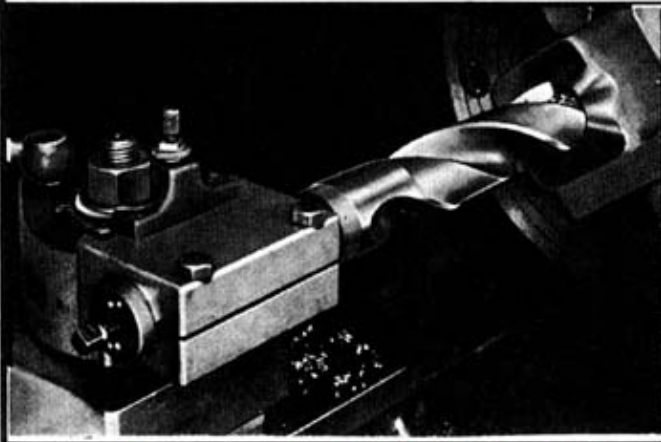
5.4



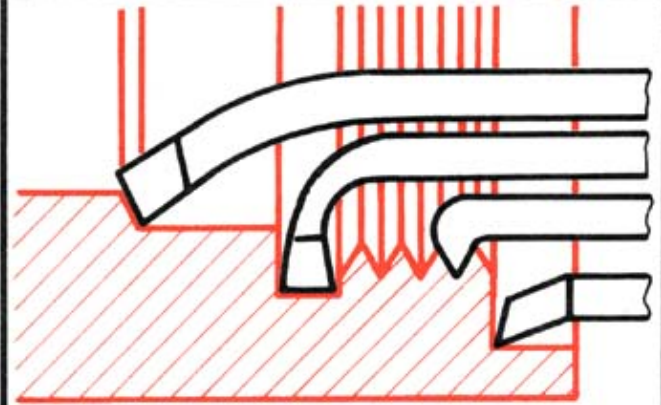
5.5

 <p>①</p>  <p>②</p>	<p>_____ 5.1</p>
 <p>③</p>  <p>④</p>	<p>_____ 5.2</p>
 <p>⑤</p>  <p>⑥</p>	<p>_____ 5.3</p>
	<p>_____ 5.4</p>
	<p>_____ 5.5</p>

6

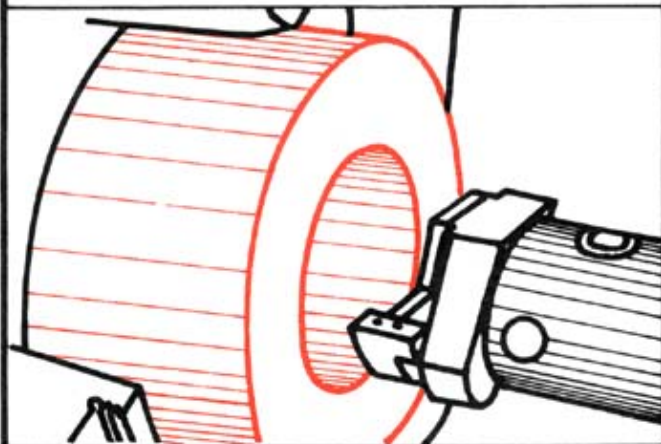



6.1

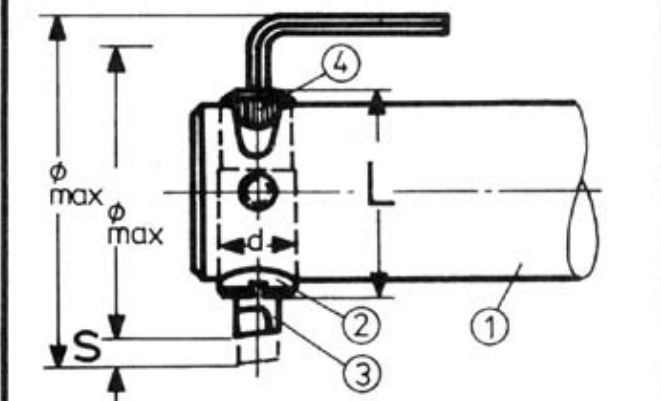


6.2

- ①
- ②
- ③
- ④

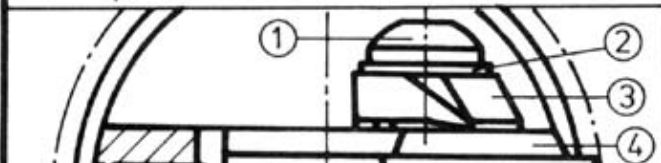


6.3



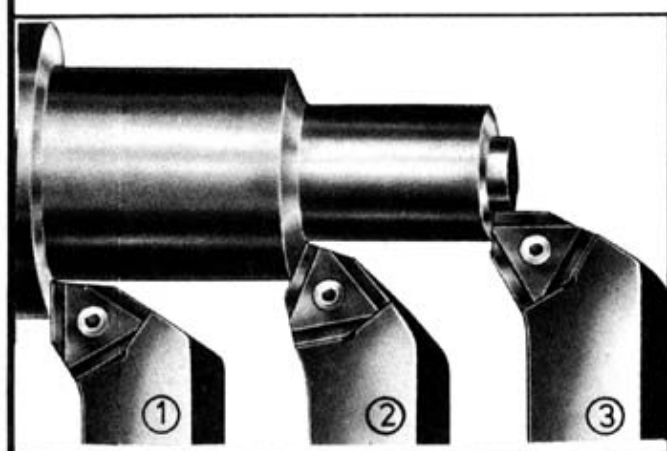
6.4

- ①
- ②
- ③
- ④

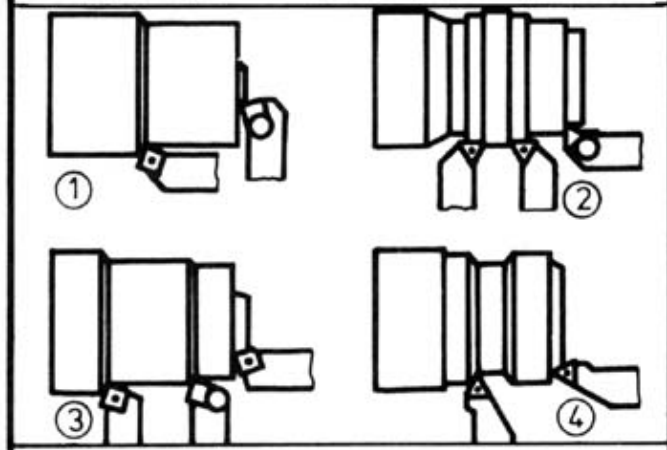


6.5

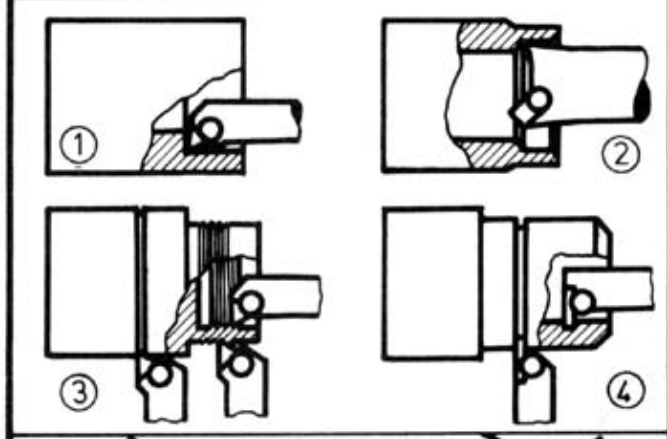
- ①
- ②



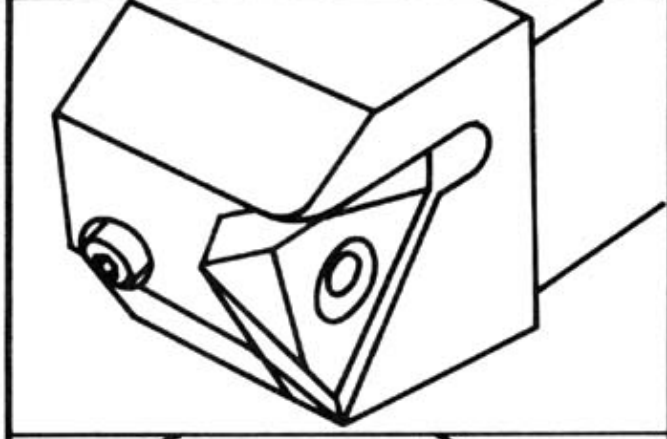
7.1



7.2



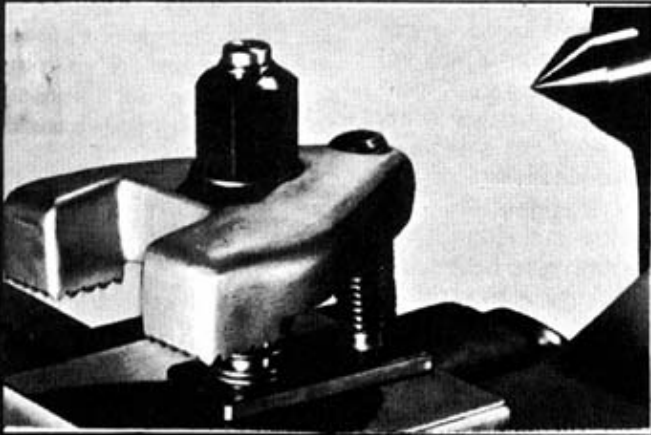
7.3



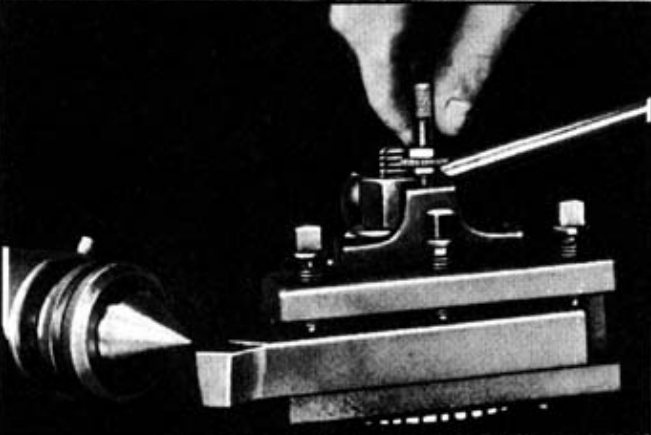
7.4



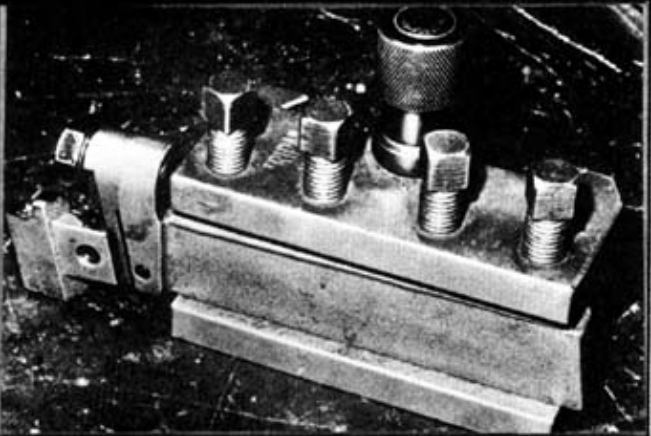
7.5



8.1



8.2



8.3



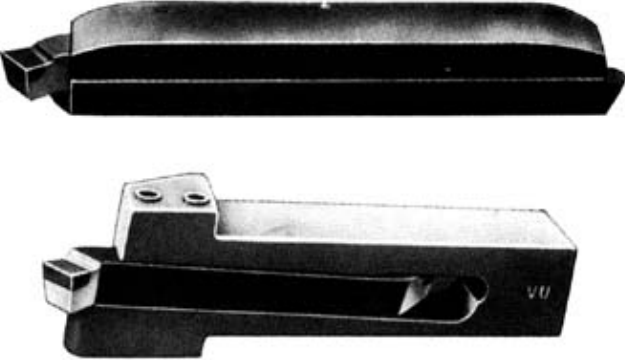
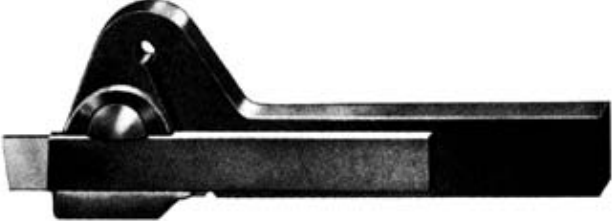
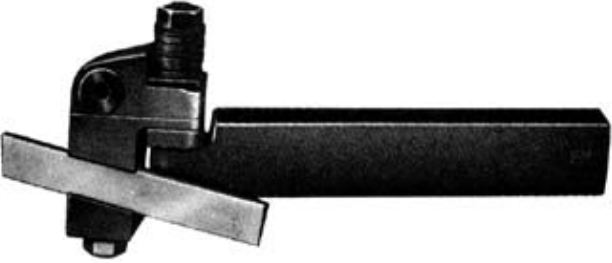
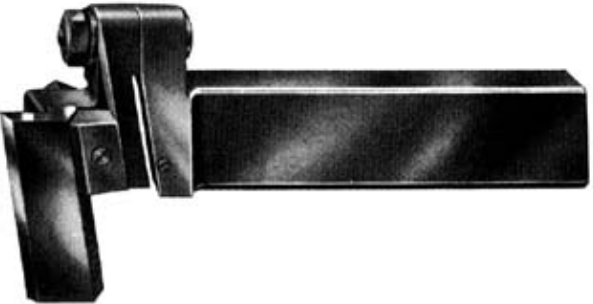

8.4

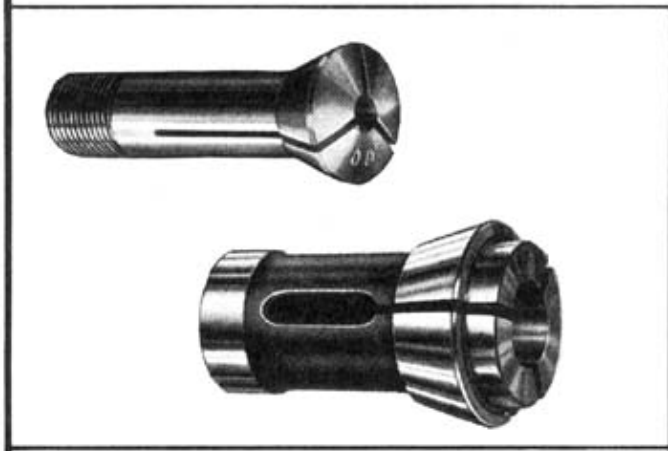


8.5

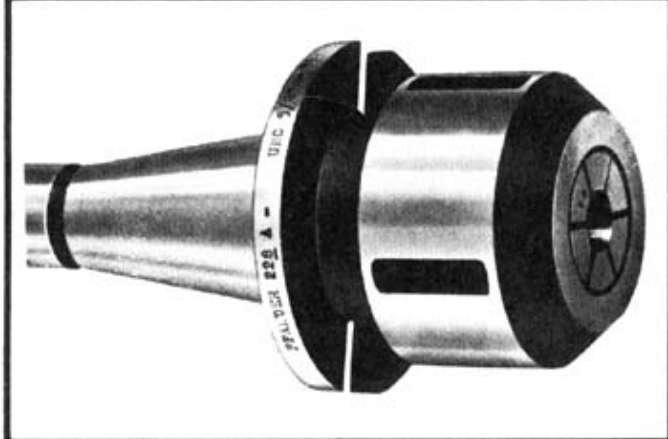


9

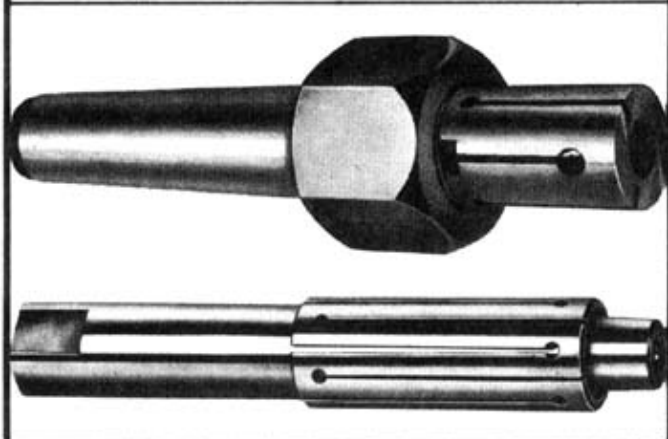
	<p>9.1</p>
	<p>9.2</p>
	<p>9.3</p>
	<p>9.4</p>
<p>61</p> 	<p>9.5</p>



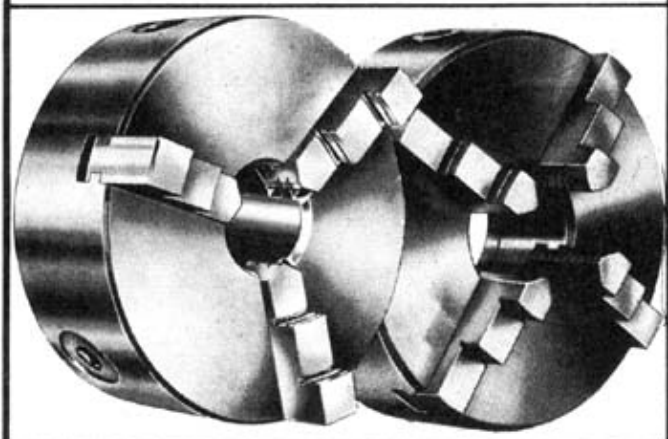
10.1




10.2



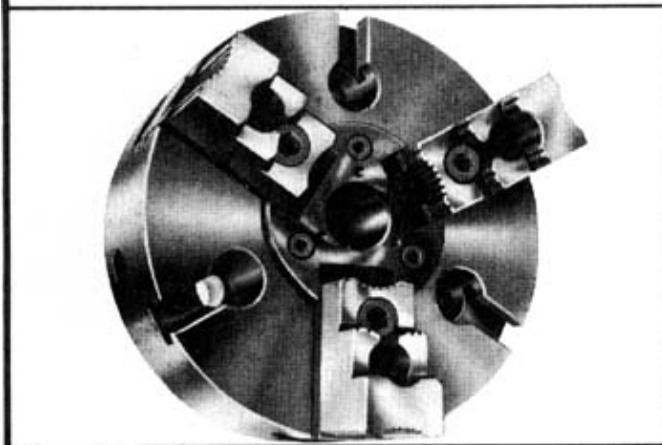
10.3



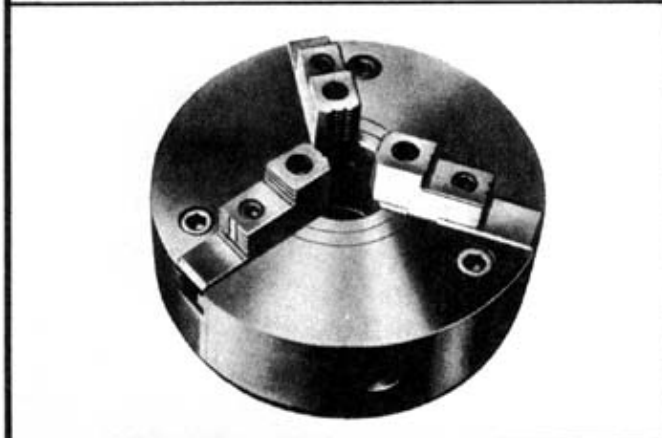
10.4



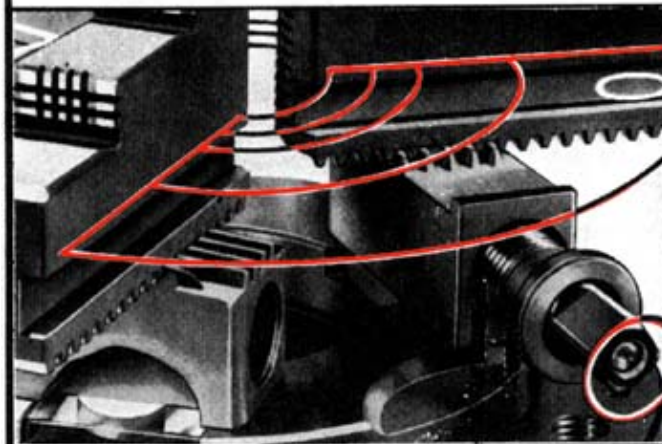

10.5



10.1



10.2



10.3

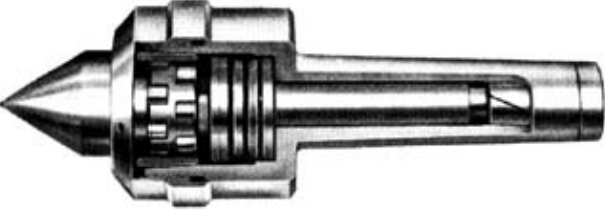
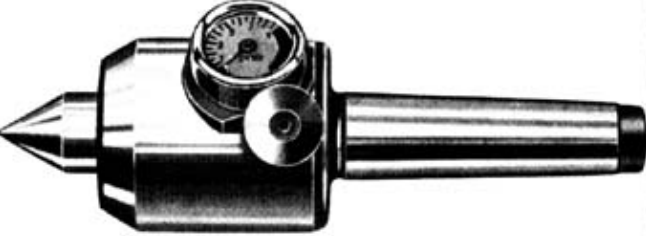
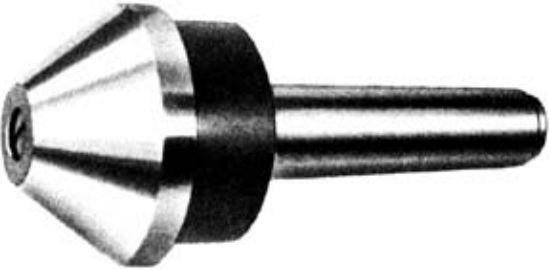
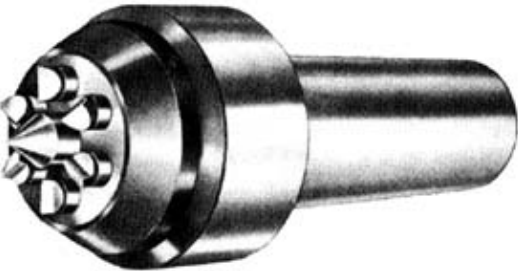



10.4

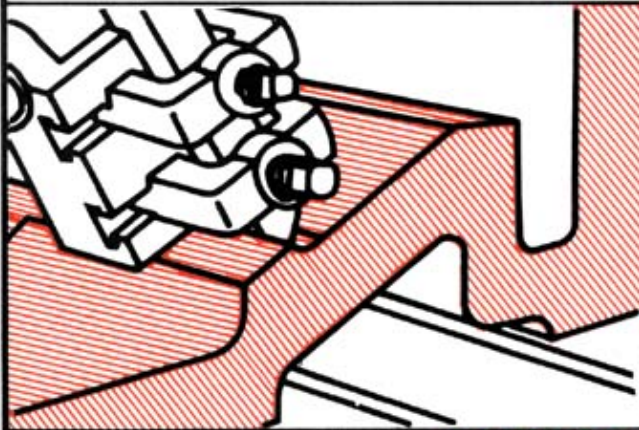
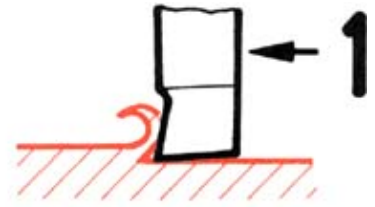


10.5

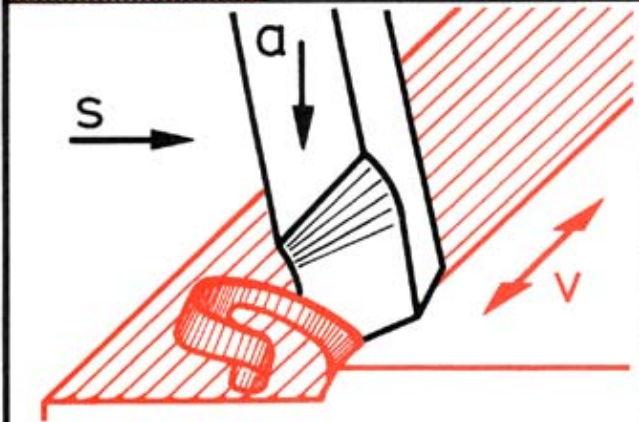


	<p>_____ 11.1</p>
	<p>_____ 11.2</p>
	<p>_____ 11.3</p>
	<p>_____ 11.4</p>
	<p>_____ 11.5</p>

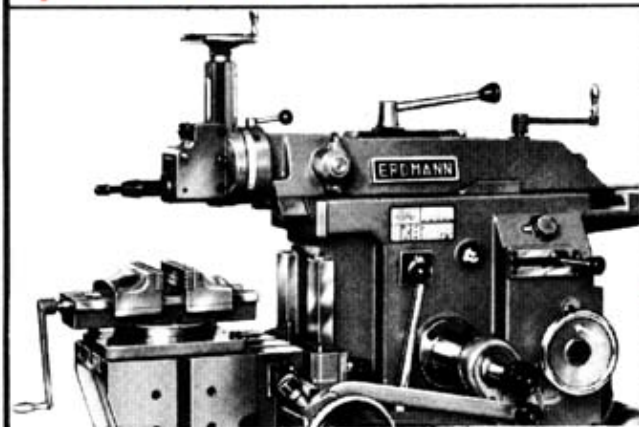
10. Shaping – Hobeln



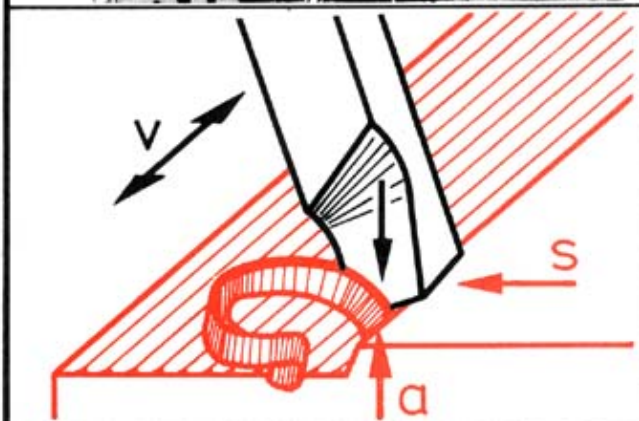
1.1



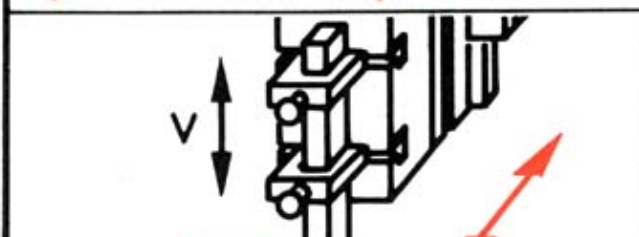
1.2



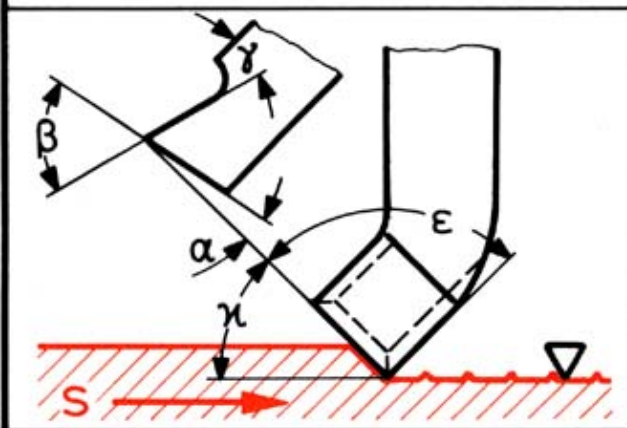
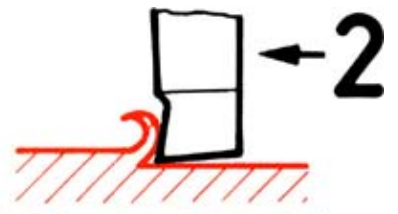
1.3



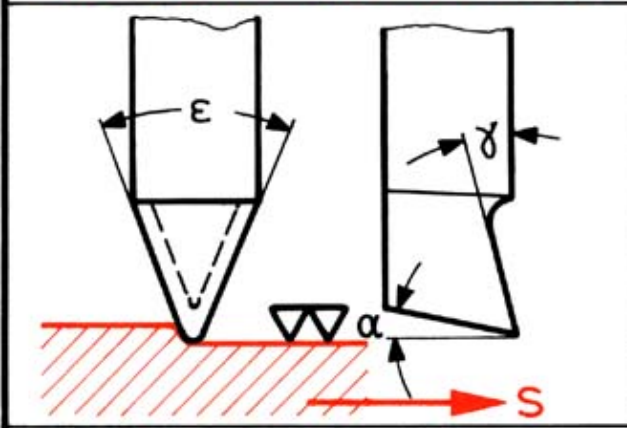
1.4



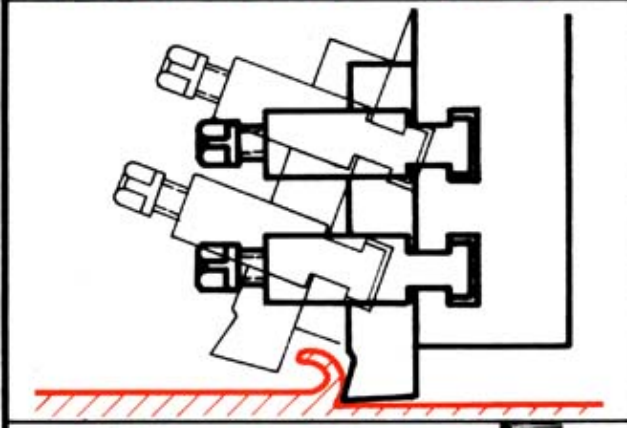
1.5



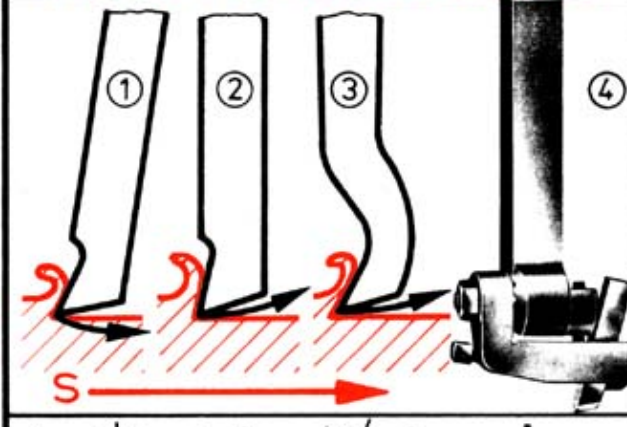
_____ 2.1



_____ 2.2



_____ 2.3



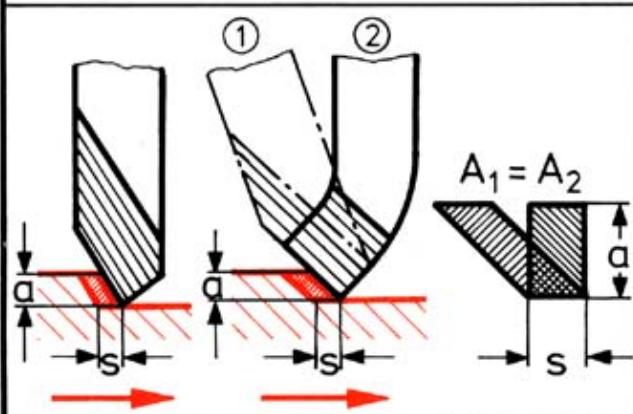
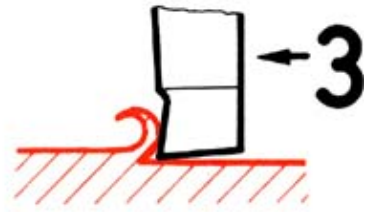
_____ 2.4

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②
③
④



_____ 2.5

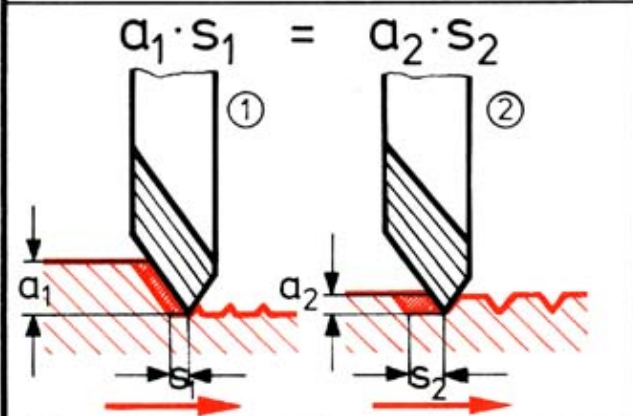
①
②



_____ 3.1

①

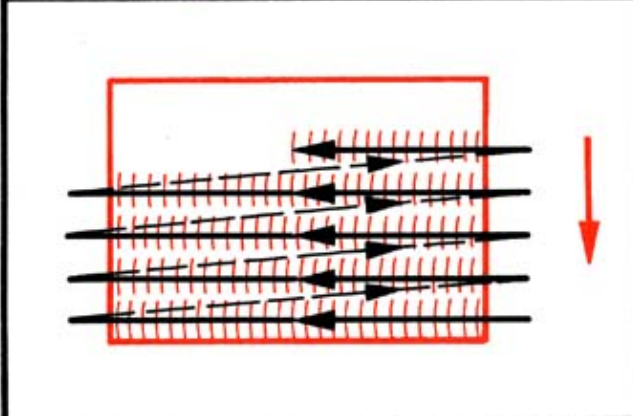
②



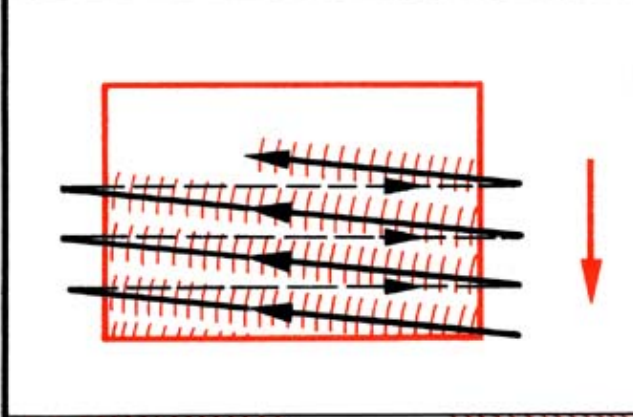
_____ 3.2

①

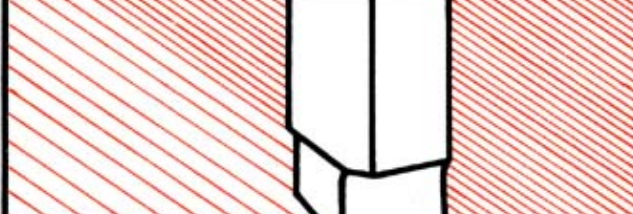
②



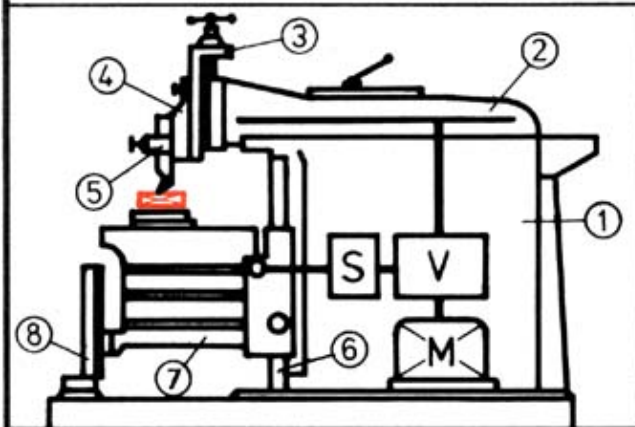
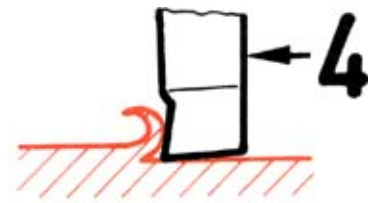
_____ 3.3



_____ 3.4

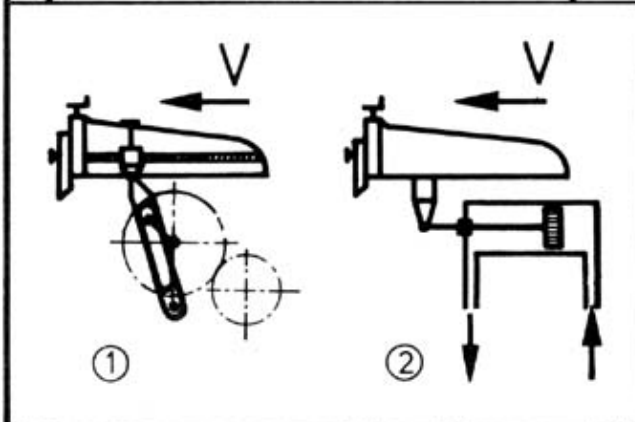


_____ 3.5



_____ 4.1

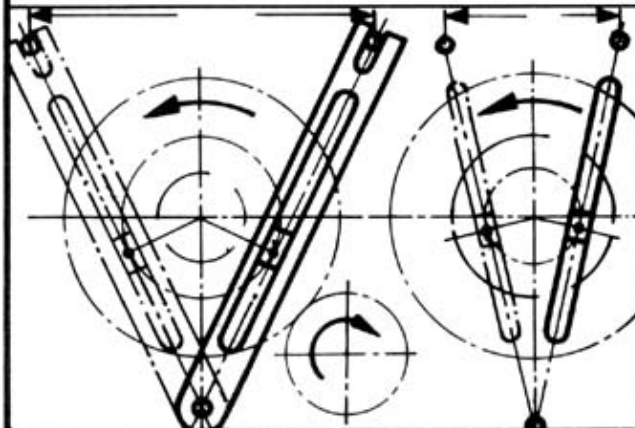
①	⑦
②	⑧
③	M
④	V
⑤	S
⑥	



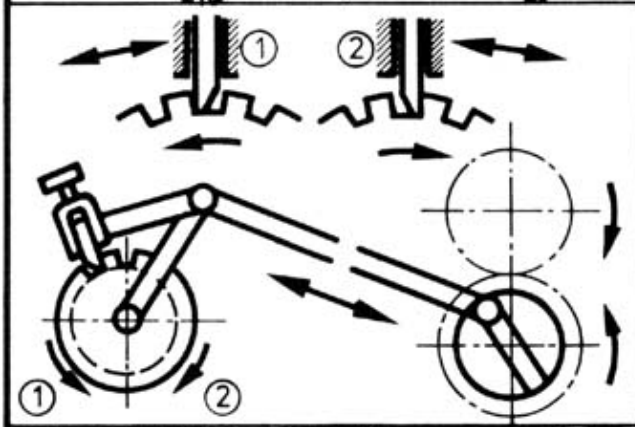
_____ 4.2

①

②



_____ 4.3



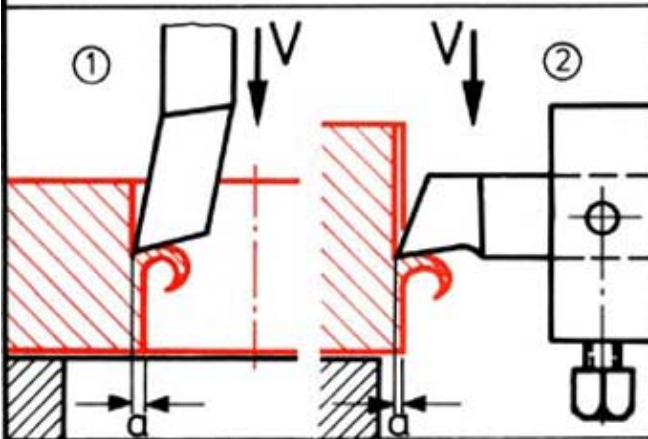
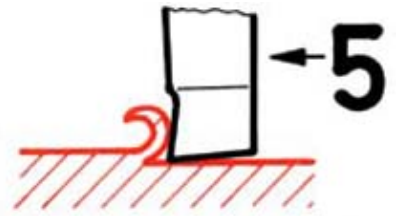
_____ 4.4

①

②



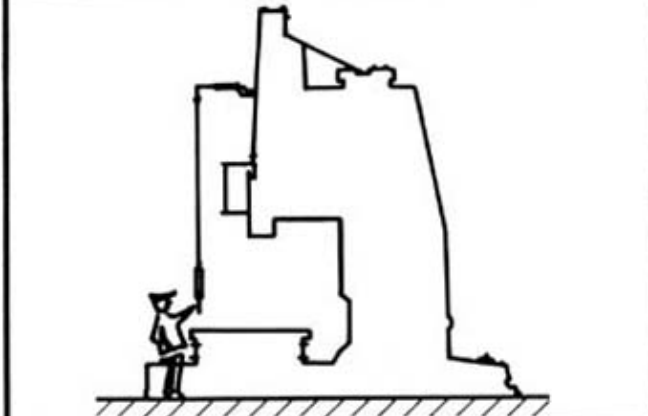
_____ 4.5



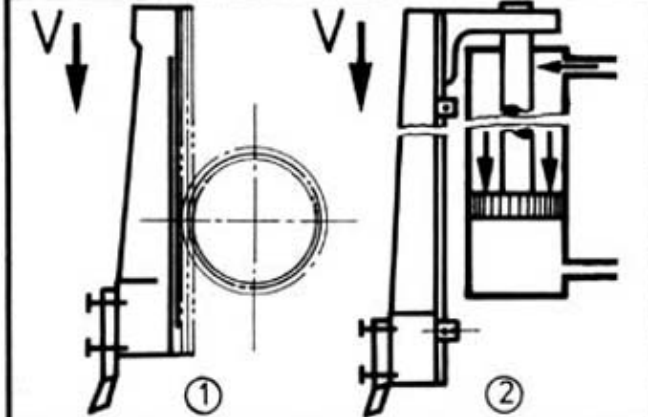
_____ 5.1

①

②



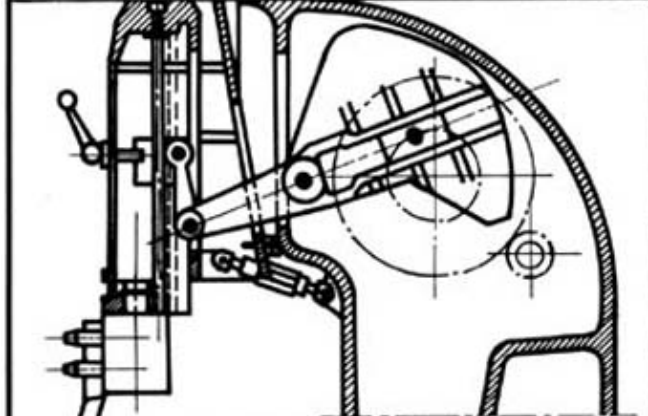
_____ 5.2



_____ 5.3

①

②



_____ 5.4



_____ 5.5

11. Thread cutting – Gewinde schneiden



	<p style="text-align: right;">1.1</p> <p>d =</p> <p>d · π =</p> <p>P =</p> <p>∠ α =</p>
--	---

	<p style="text-align: right;">DIN(M) 1.2</p> <p>d =</p> <p>P =</p> <p>$t_1 = 0,6495 \cdot P \approx 0,1 \cdot d =$</p> <p>$d_2 = d - 0,6495 \cdot P =$</p> <p>$d_1 = d - 1,299 \cdot P \approx 0,8 \cdot d =$</p> <p>∠ 60° =</p>
--	---

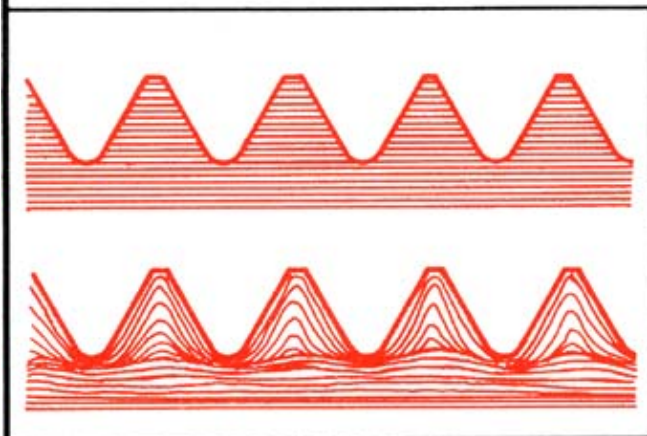
	<p style="text-align: right;">ISO(M) 1.3</p> <p>d = D =</p> <p>P =</p> <p>d₃ =</p> <p>D₁ =</p> <p>d₂ = D₂ =</p> <p>∠ 60° =</p>
--	--

	<p style="text-align: right;">Whitworth (") 1.4</p> <p>d = D =</p> <p>P =</p> <p>d₁ =</p> <p>d₂ =</p> <p>∠ 55° =</p> <p>z =</p>
--	---

	<p style="text-align: right;">1.5</p> <p>1" =</p> <p>R 1" =</p> <p>1/2" =</p> <p>R 1/2" =</p>
--	---



<p>M 16 M 16 x 1</p> <p>① ②</p> <p>1" (W 24 x 1/10")</p>	<p>_____ 2.1</p> <p>① M 16 =</p> <p>1" =</p> <p>② M 16 x 1 =</p> <p>W 24 x 1/10 =</p> <p>M 2 x 0,25 =</p> <p>M 50 x 1,5 =</p>
<p>F F</p> <p>F F</p> <p>F F</p> <p>F F</p>	<p>_____ 2.2</p> <p>①</p> <p>②</p> <p>③</p> <p>④</p>
<p>①</p> <p>②</p>	<p>_____ 2.3</p> <p>①</p> <p>②</p>
<p>① ②</p>	<p>_____ 2.4</p> <p>①</p> <p>②</p>
<p>73</p>	<p>_____ 2.5</p> <p>①</p> <p>②</p>



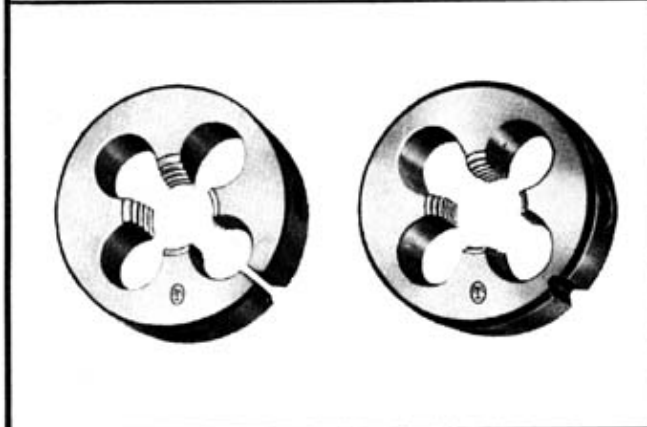
①

②

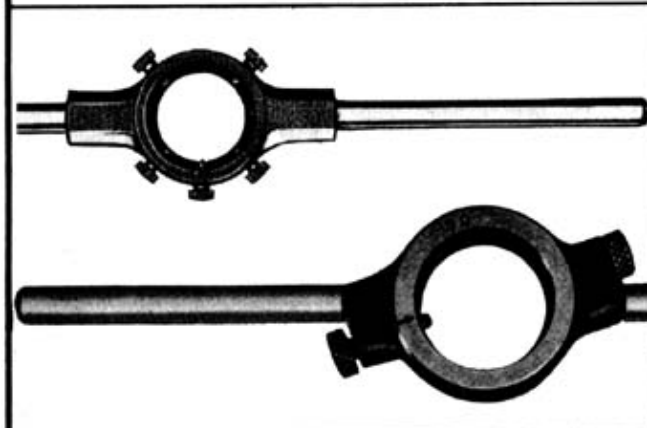
3.1



3.2



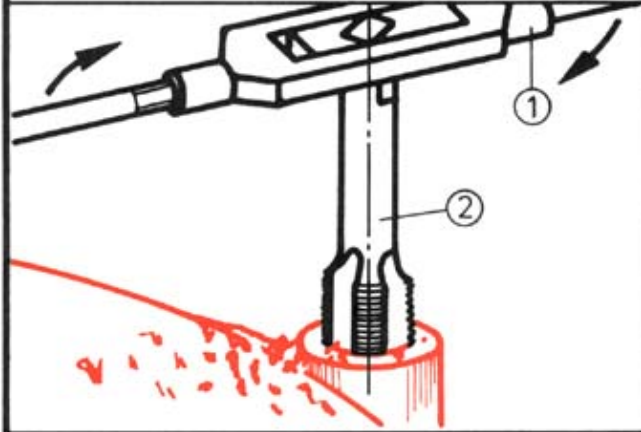
3.3



3.4

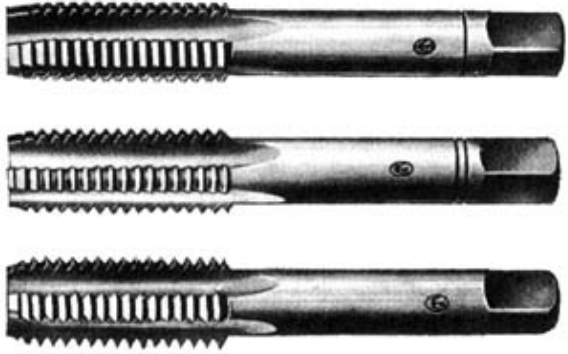


3.5



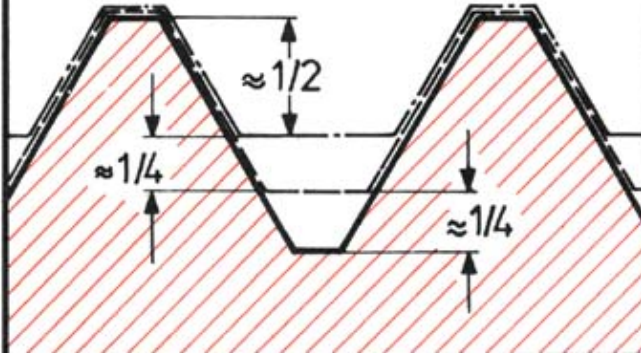
4.1

- ①
- ②



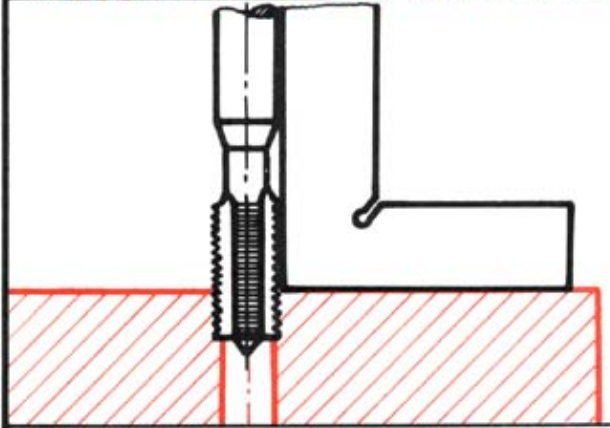
4.2

- ①
- ②
- ③



4.3

- ①
- ②
- ③



4.4



4.5

- ①

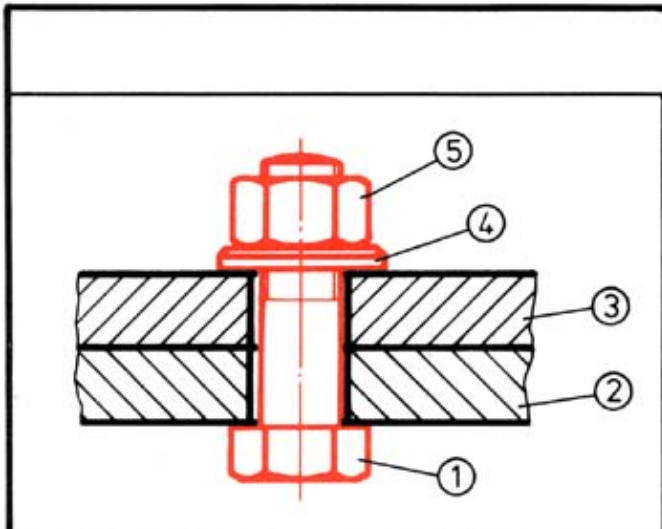
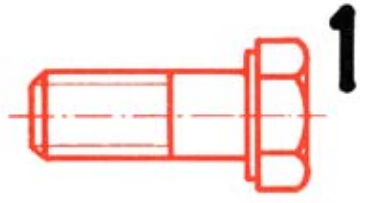


	<p>_____ 5.1</p>
	<p>_____ 5.2</p>
	<p>_____ 5.3</p>
	<p>_____ 5.4</p>
	<p>_____ 5.5</p>



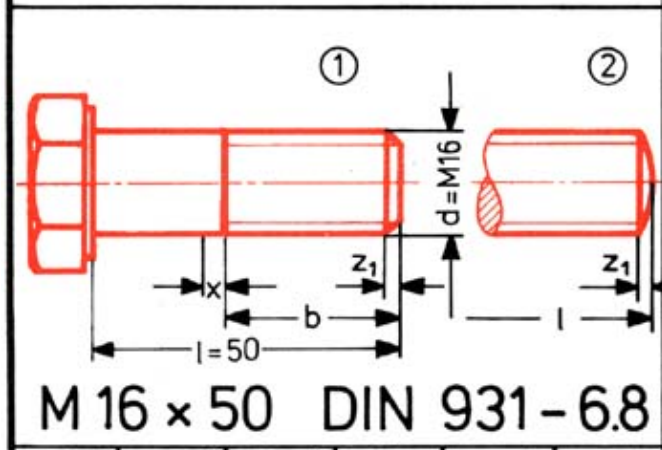
	<p>_____ 6.1</p>
	<p>_____ 6.2</p>
	<p>_____ 6.3</p>
	<p>_____ 6.4</p>
	<p>_____ 6.5</p>

12. Threaded joints – Schraubenverbindungen



_____ 1.1

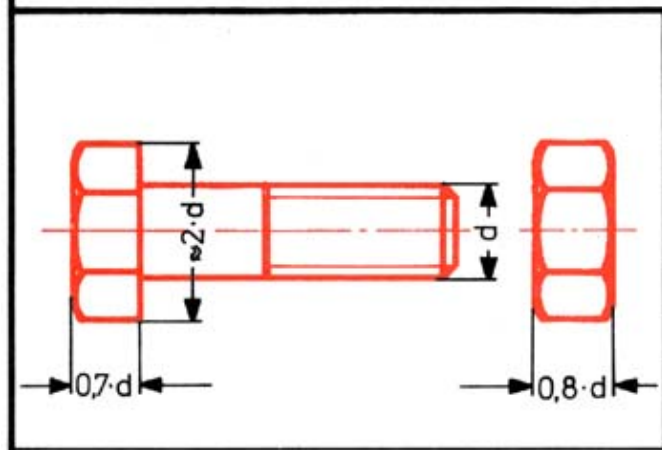
①
②
③
④
⑤



_____ 1.2

①
②
M 16 —
50 —
DIN 931-
6. .8

4A	4D	4S	5D	5S	6D	6S	6G	8G	10K	12K	-
3.6	4.6	4.8	5.6	5.8	6.6	6.8	6.9	8.8	10.9	12.9	14.9
			☒					☒	☐	☐	☐

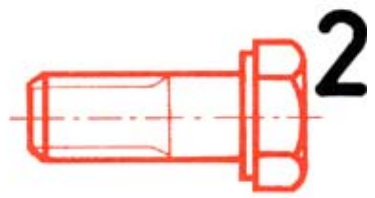


_____ 1.4



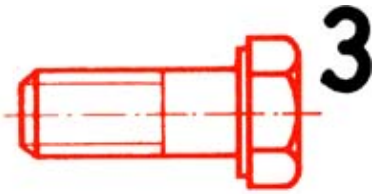
_____ 1.5

①



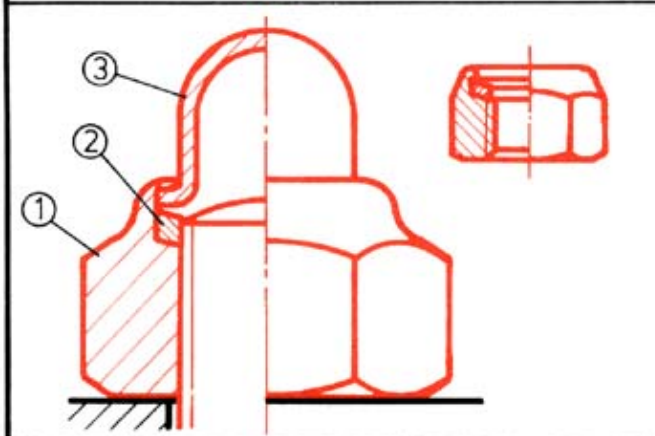
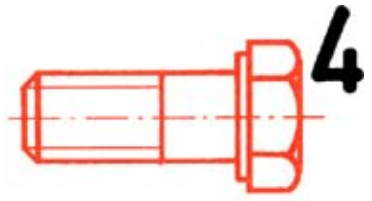
2

	<p>_____ 2.1</p> <p>①</p> <p>②</p> <p>③</p> <p>④</p>
	<p>_____ 2.2</p> <p>①</p> <p>②</p> <p>③</p>
	<p>_____ 2.3</p> <p>①</p> <p>②</p> <p>③</p>
	<p>_____ 2.4</p> <p>①</p> <p>②</p>
	<p>_____ 2.5</p> <p>①</p> <p>②</p>



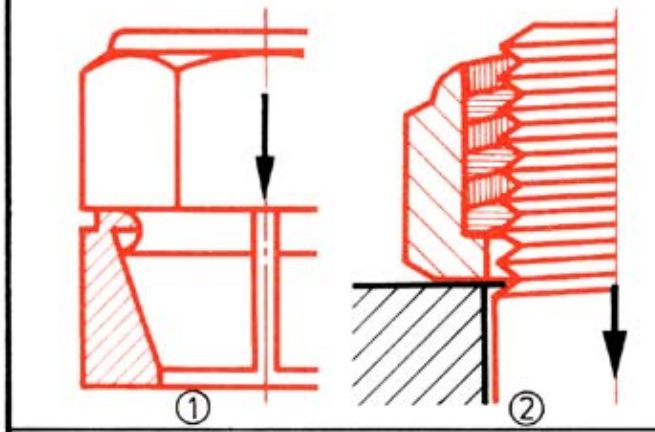
3

<p style="text-align: center;">① ②</p>	<p style="text-align: right;">_____ 3.1</p> <p>①</p> <p>②</p>
<p style="text-align: center;">DIN 93 DIN 432</p>	<p style="text-align: right;">_____ 3.2</p> <p>①</p> <p>②</p> <p>③</p>
	<p style="text-align: right;">_____ 3.3</p> <p>①</p> <p>②</p> <p>③</p>
	<p style="text-align: right;">_____ 3.4</p> <p>①</p> <p>②</p> <p>③</p> <p>④</p>
<p>81</p>	<p style="text-align: right;">_____ 3.5</p>



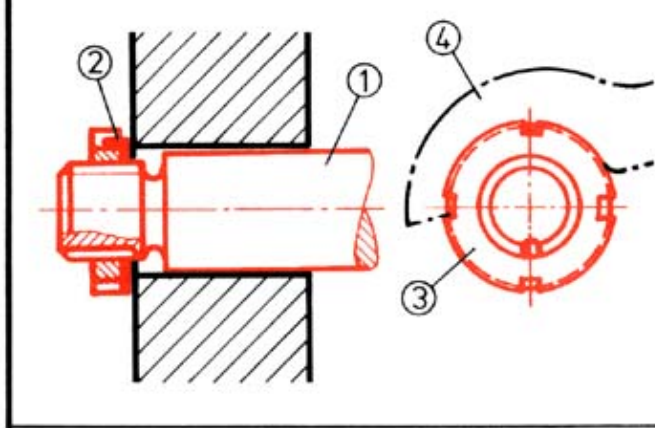
_____ 4.1

- ①
- ②
- ③



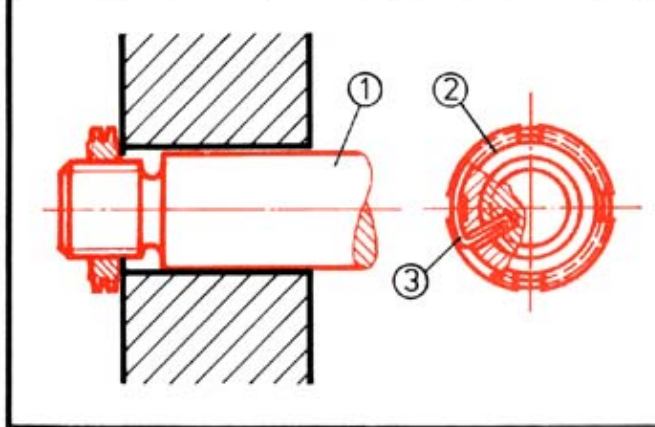
_____ 4.2

- ①
- ②



_____ 4.3

- ①
- ②
- ③
- ④

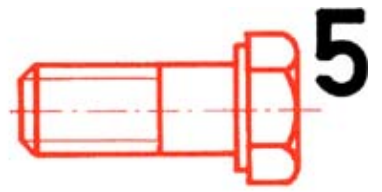


_____ 4.4

- ①
- ②
- ③

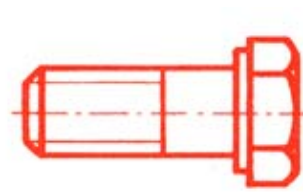


_____ 4.5


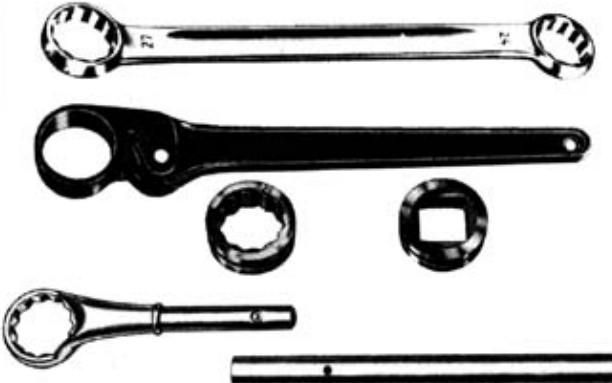
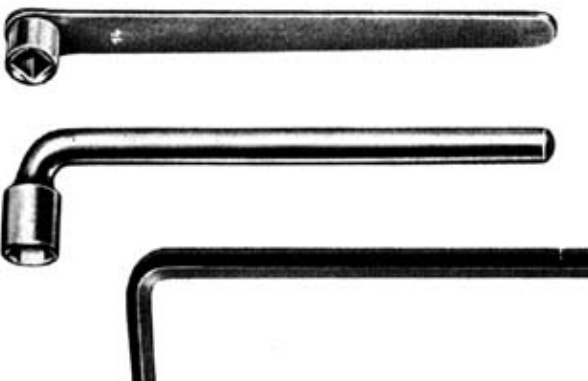
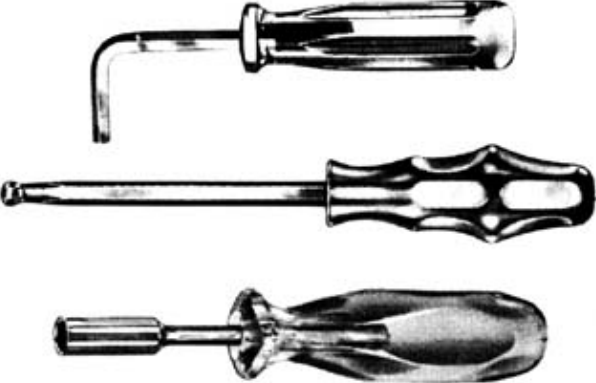



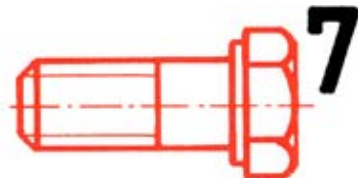
5

<p>① ② ③</p>	<p>_____ 5.1</p> <p>①</p> <p>②</p> <p>③</p>
<p>① ② ③</p>	<p>_____ 5.2</p> <p>①</p> <p>②</p> <p>③</p>
<p>① ② ③</p> <p>① ② ③</p>	<p>_____ 5.3</p> <p>①</p> <p>②</p> <p>③</p>
<p>①</p> <p>②</p> <p>③</p>	<p>_____ 5.4</p> <p>①</p> <p>②</p> <p>③</p>
<p>83</p>	<p>_____ 5.5</p>

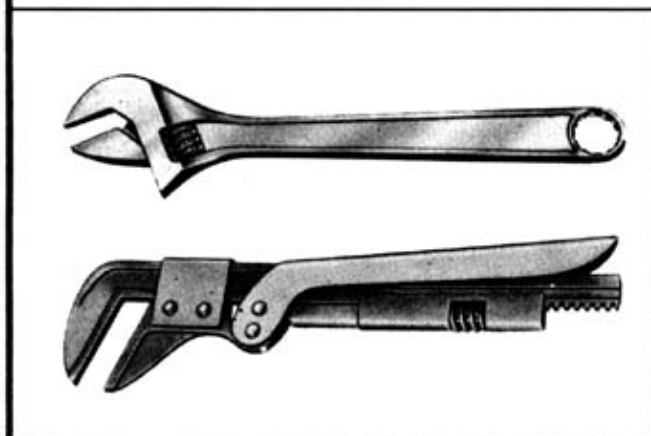


6

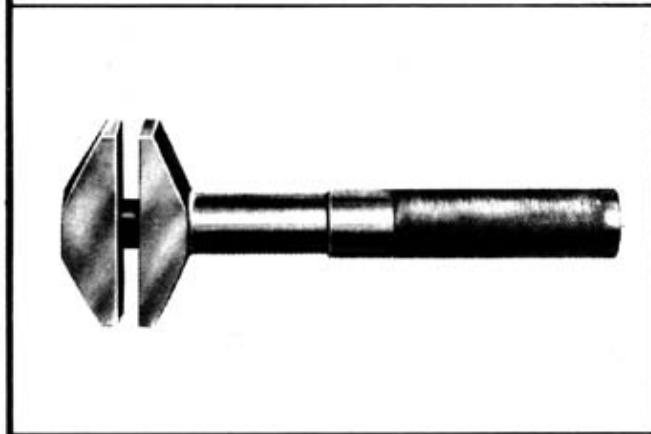
	<p>_____ 6.1</p>
	<p>_____ 6.2</p>
	<p>_____ 6.3</p>
	<p>_____ 6.4</p>
	<p>_____ 6.5</p>



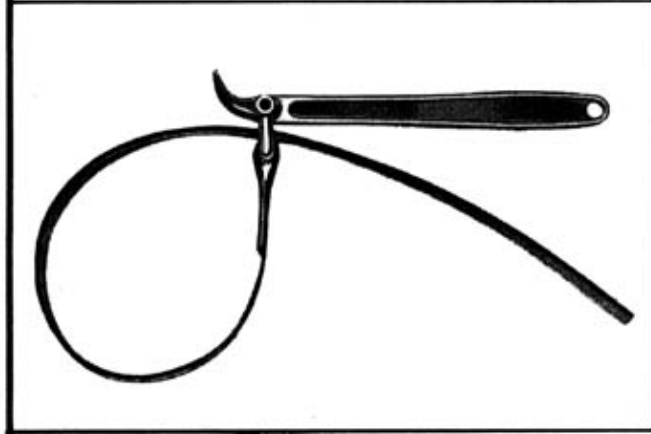
_____ 7.1



_____ 7.2



_____ 7.3

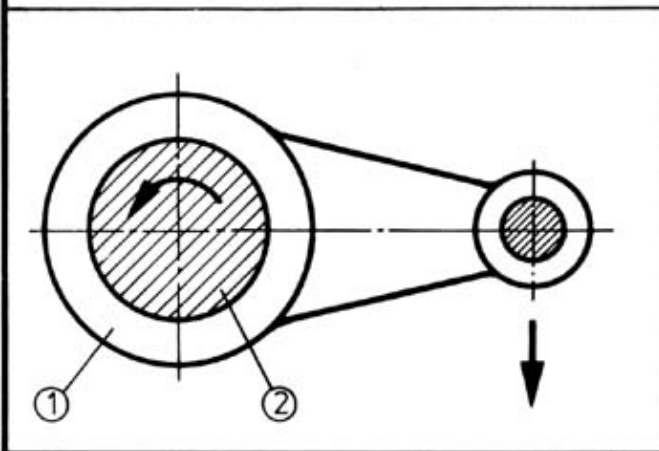
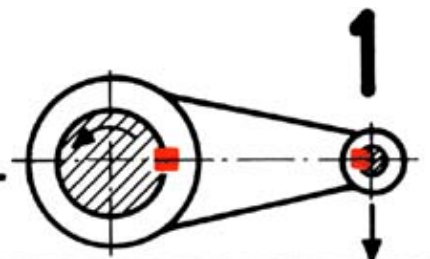


_____ 7.4



_____ 7.5

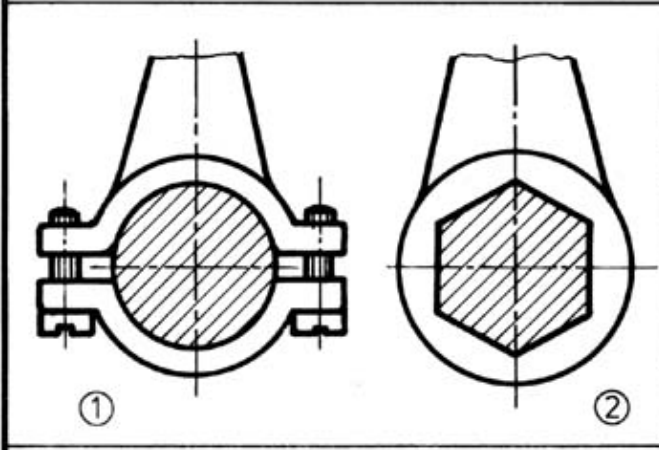
13. Keyed joints – Keilverbindungen



_____ 1.1

①

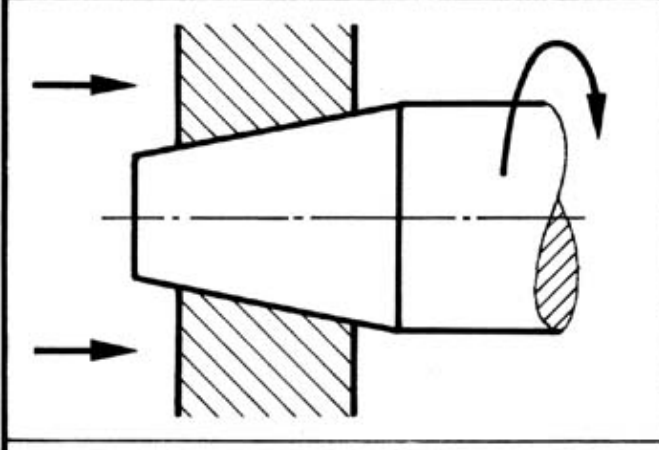
②



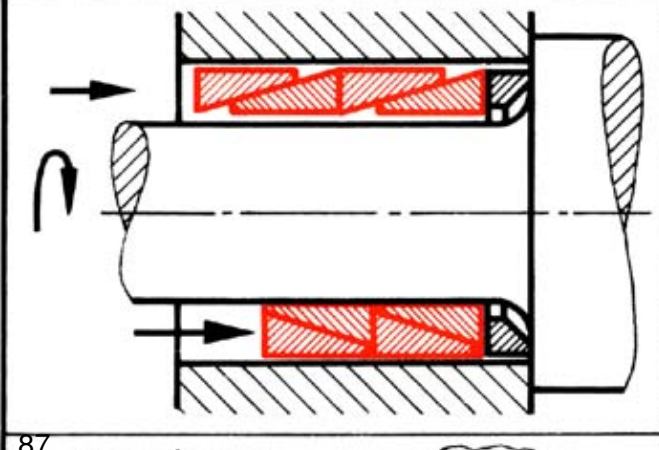
_____ 1.2

①

②



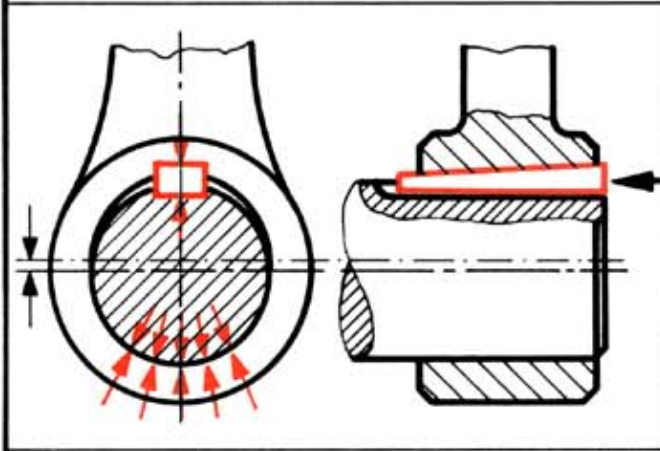
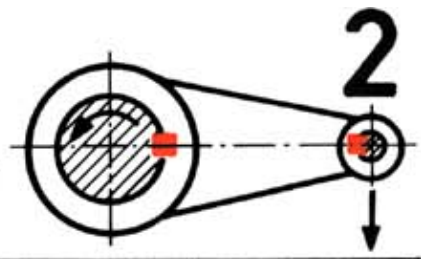
_____ 1.3



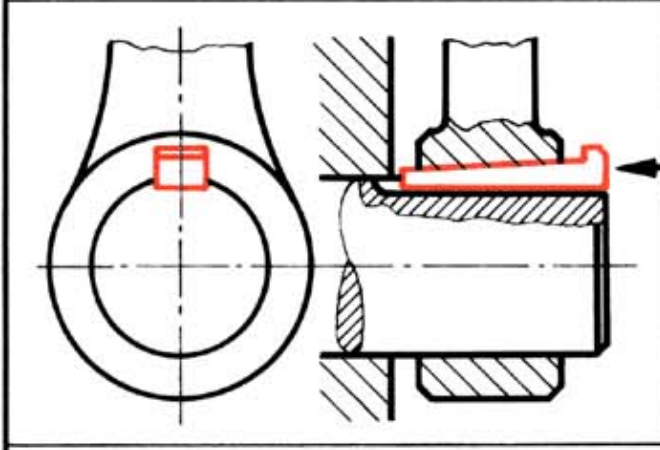
_____ 1.4



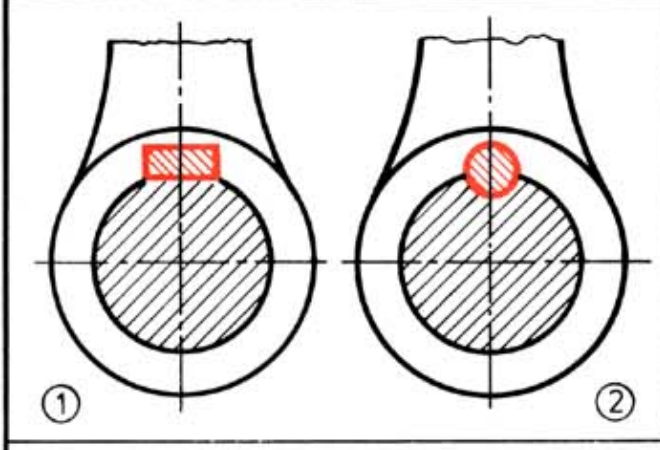
_____ 1.5



_____ 2.1



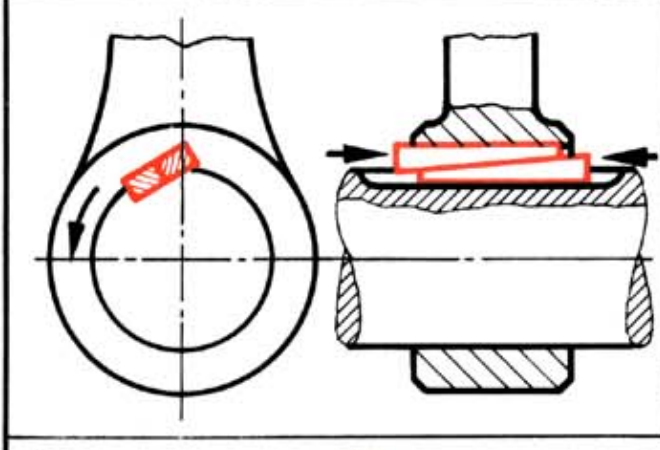
_____ 2.2

_____ 2.3

①

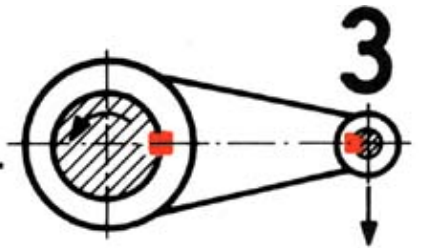
②



_____ 2.4

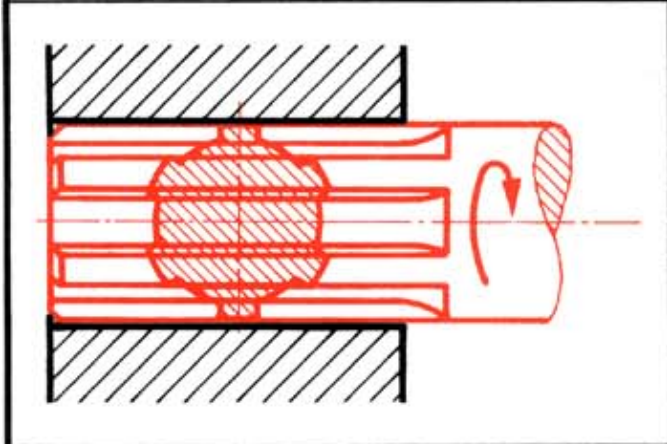
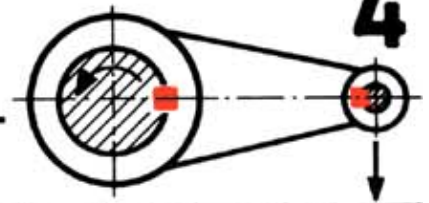


_____ 2.5

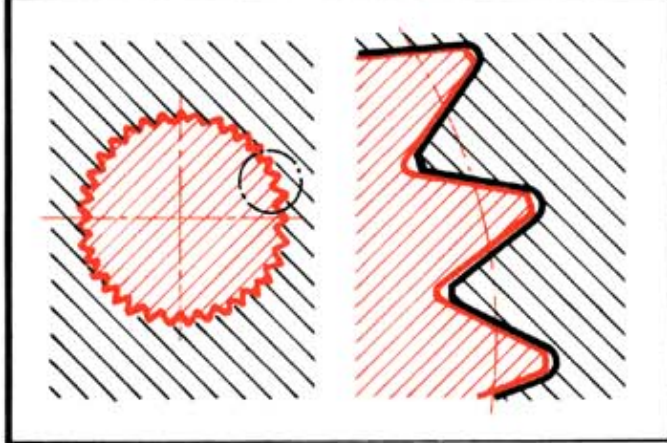


<p style="text-align: center;">① ②</p> <p style="text-align: center;">1 : 100</p>	<p style="text-align: right;">3.1</p> <hr/> <p>①</p> <p>②</p>
	<p style="text-align: right;">3.2</p> <hr/>
	<p style="text-align: right;">3.3</p> <hr/>
<p style="text-align: center;">① ②</p> <p style="text-align: center;">① ②</p>	<p style="text-align: right;">3.4</p> <hr/> <p>①</p> <p>②</p>
<p>89</p>	<p style="text-align: right;">3.5</p> <hr/>

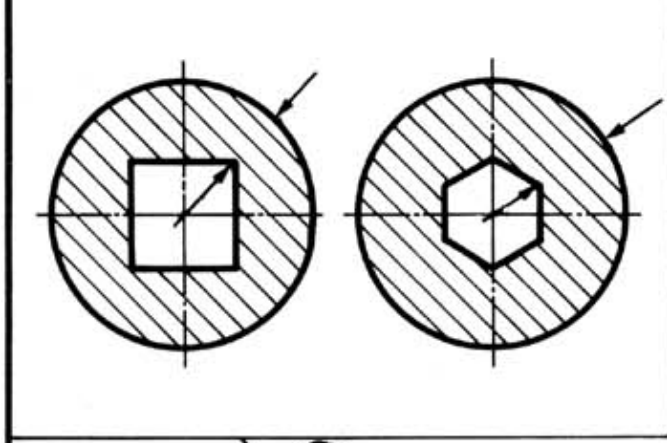
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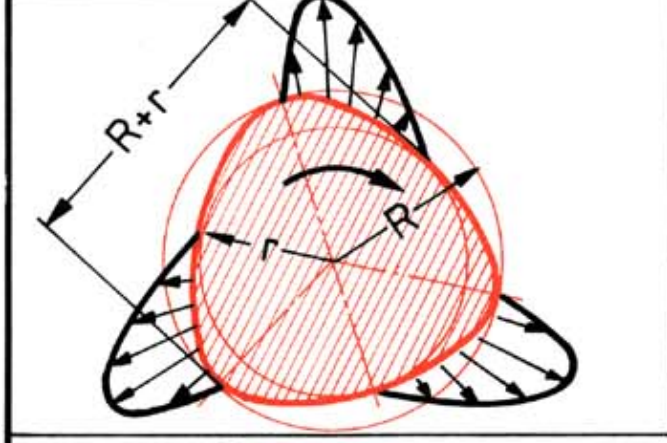
4.1



4.2



4.3

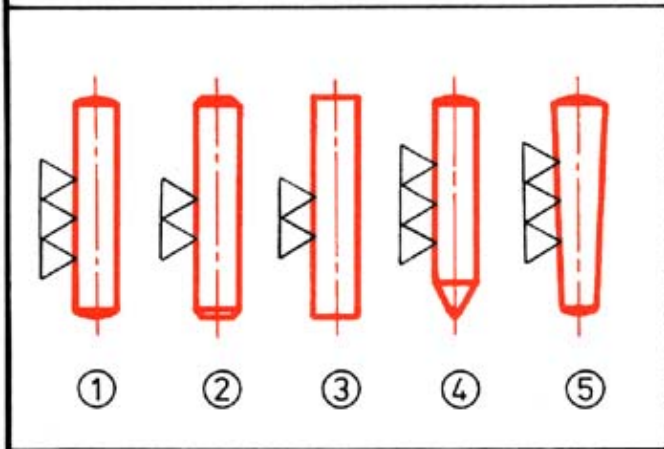
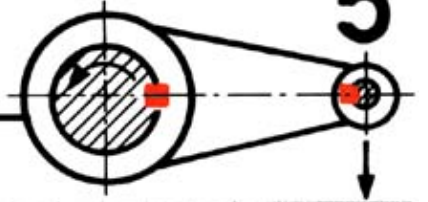


4.4



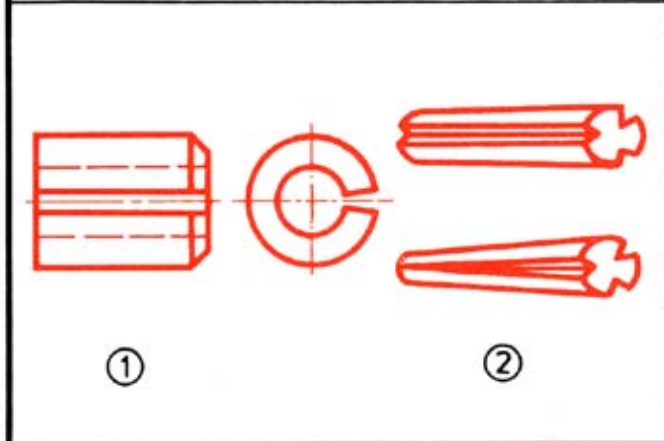
4.5

5



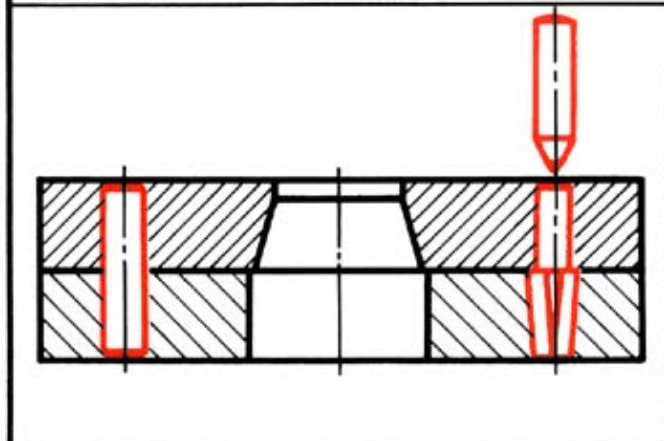
- ①
- ②
- ③
- ④
- ⑤

5.1



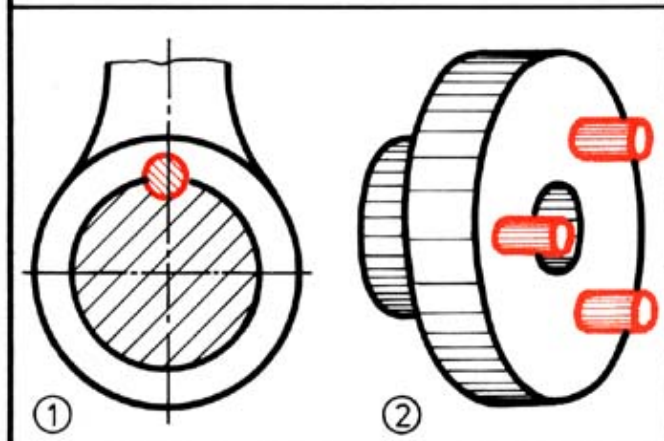
- ①
- ②

5.2



- ①

5.3



- ①
- ②

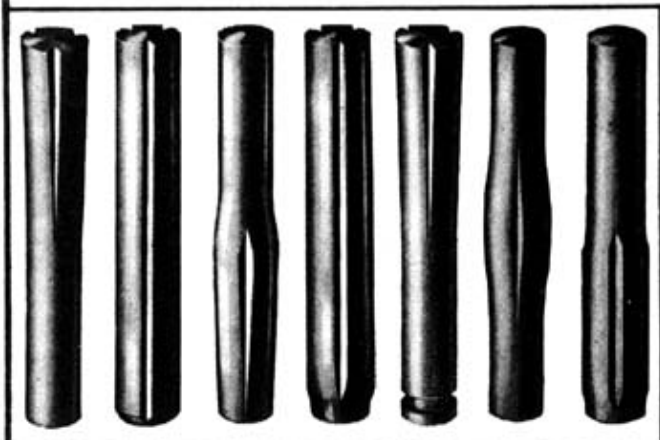
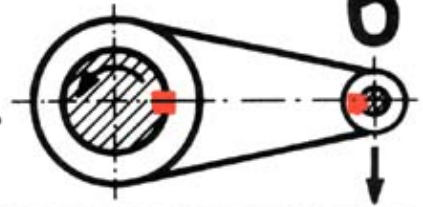
5.4



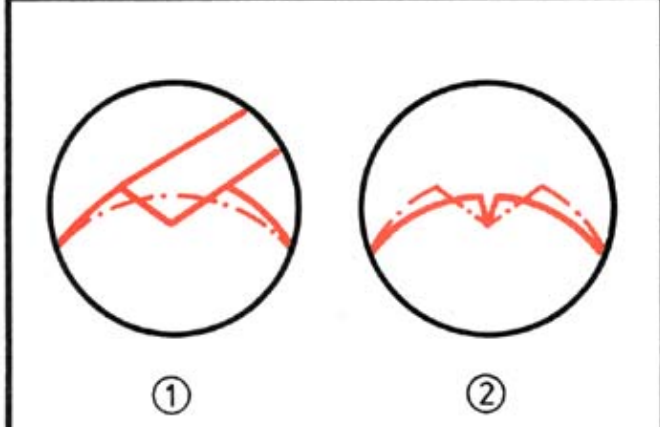
- ①

5.5

6

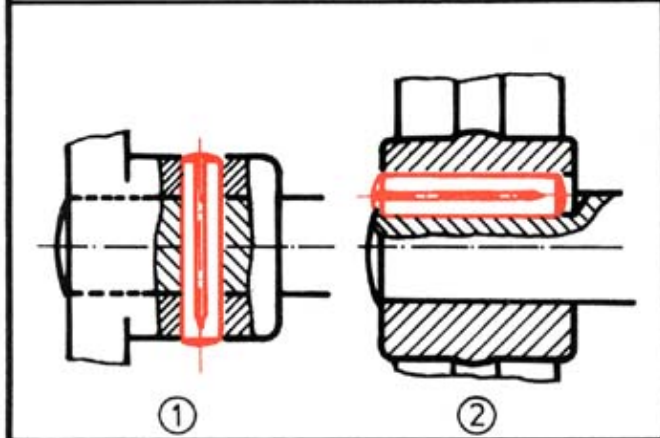


6.1



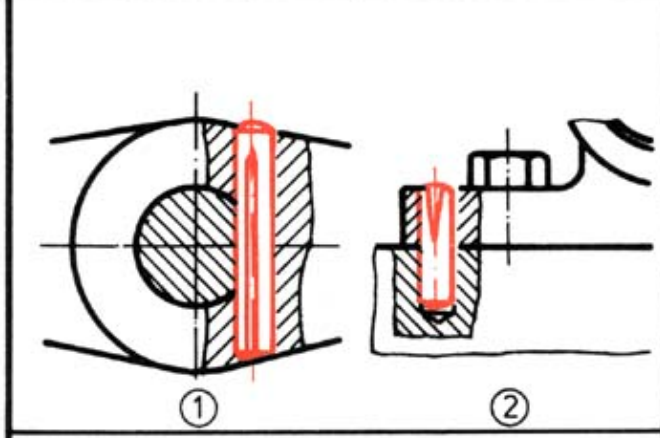
6.2

- ①
- ②



6.3

- ①
- ②



6.4

- ①
- ②

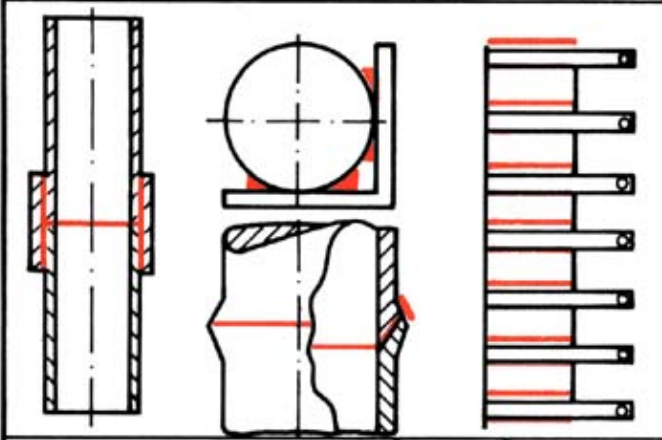


6.5

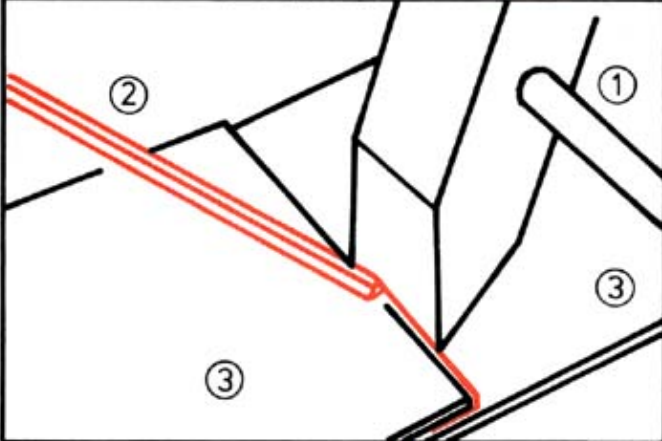
- ①

14. Soldering joints – Lötverbindungen

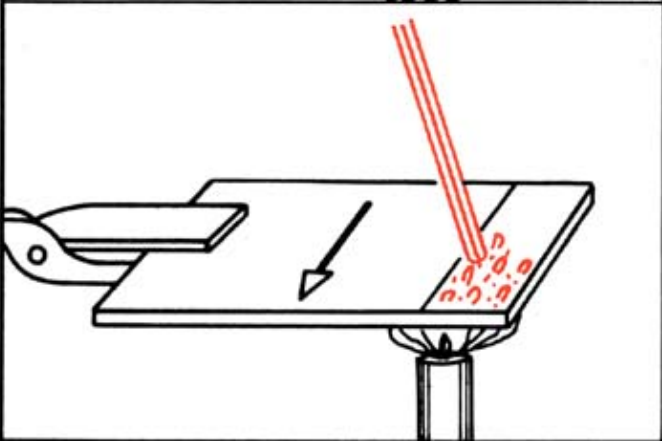
1



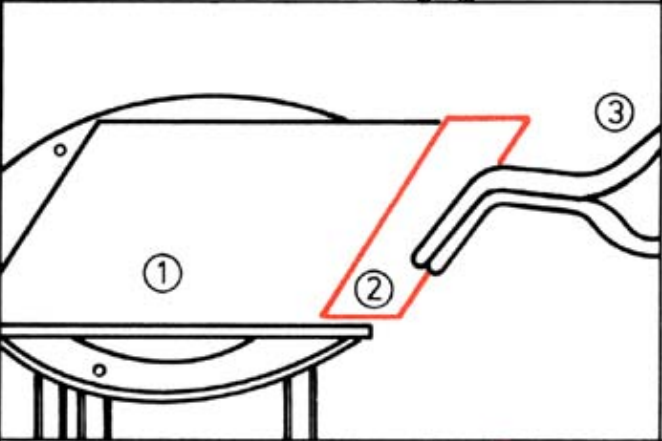
1.1



1.2



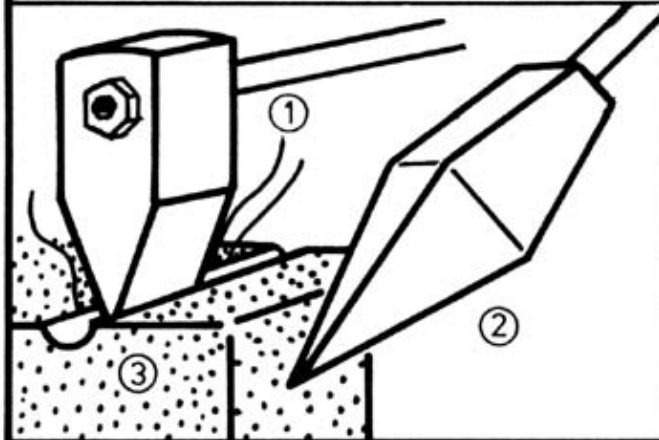
1.3



1.4



1.5



_____ 2.1

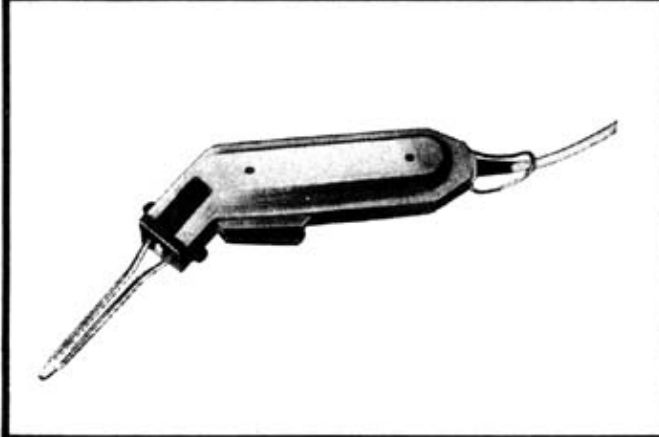
- ①
- ②
- ③



_____ 2.2



_____ 2.3



_____ 2.4

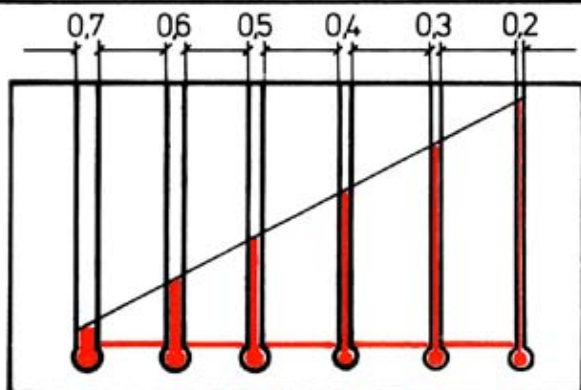


_____ 2.5

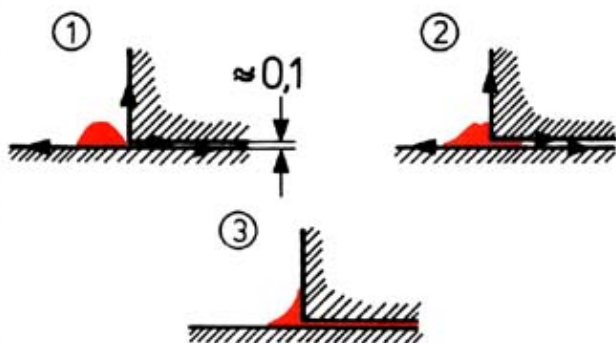
3



3.1

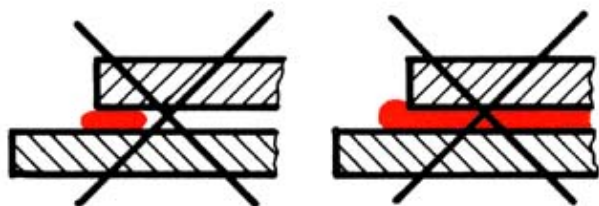


3.2

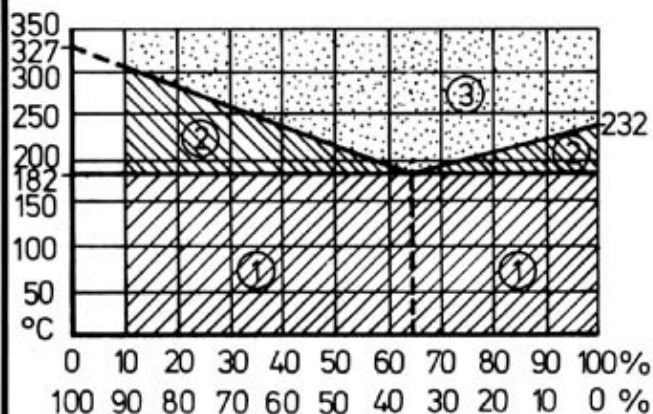


- ①
- ②
- ③

3.3

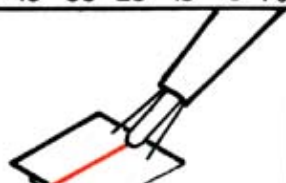
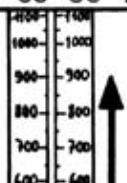


3.4

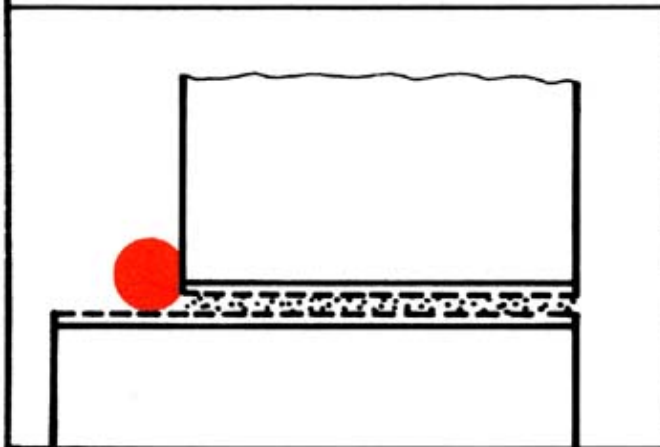


- ①
- ②
- ③

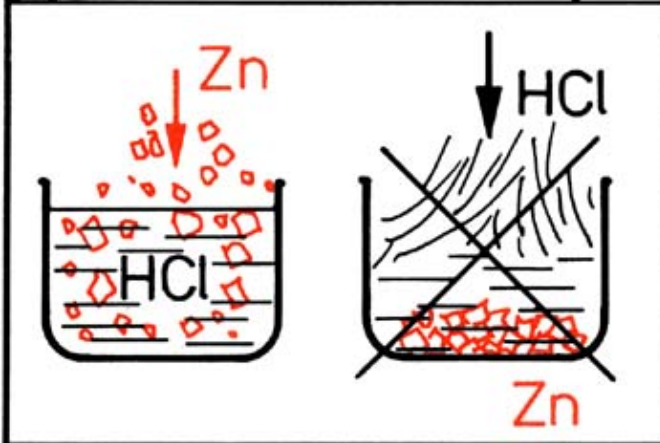
3.5



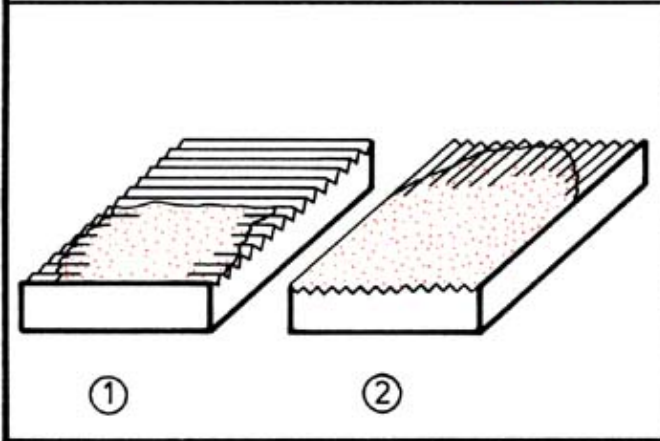
1080 °C —
945°...1020°C-



_____ 4.1

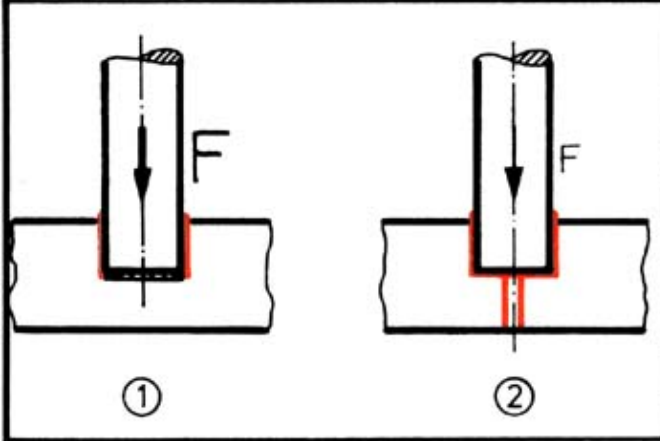


_____ 4.2



_____ 4.3

- ①
- ②



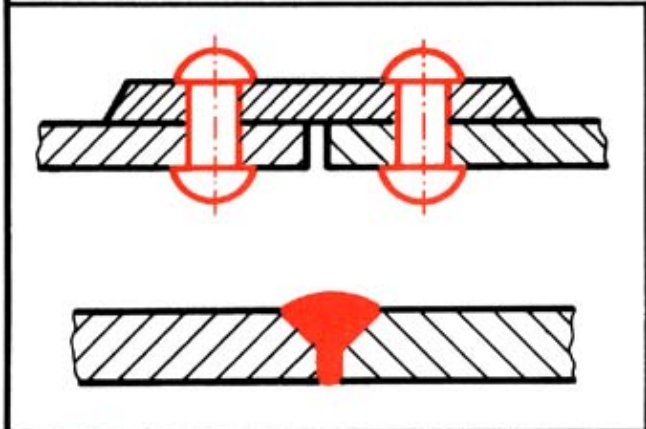
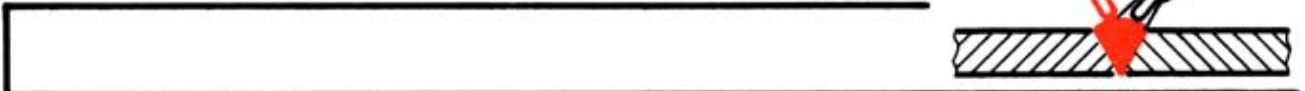
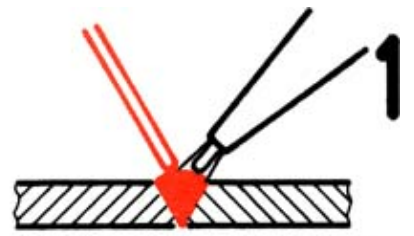
_____ 4.4

- ①
- ②

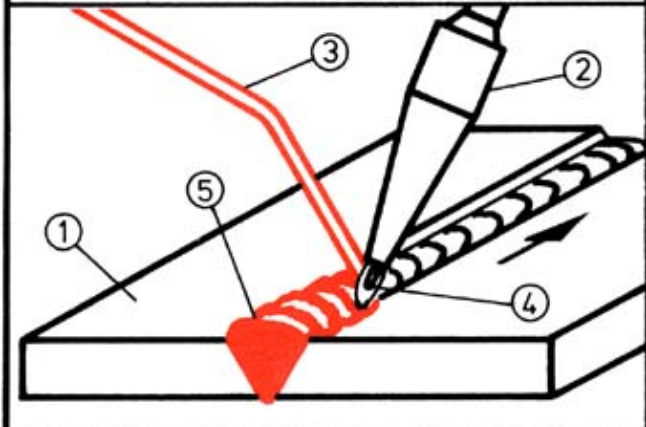


_____ 4.5

15. Welded joints – Schweißverbindungen

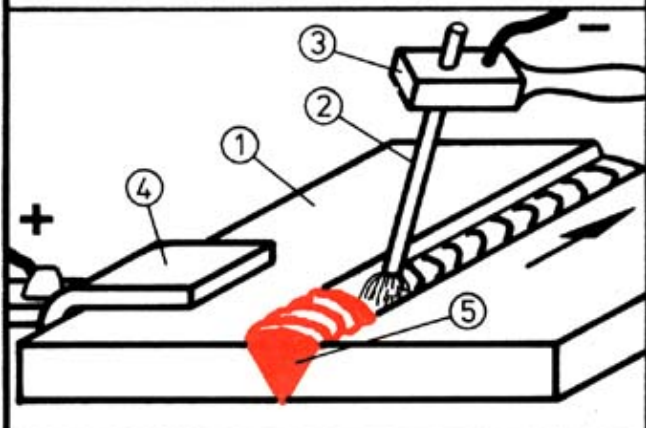


_____ 1.1



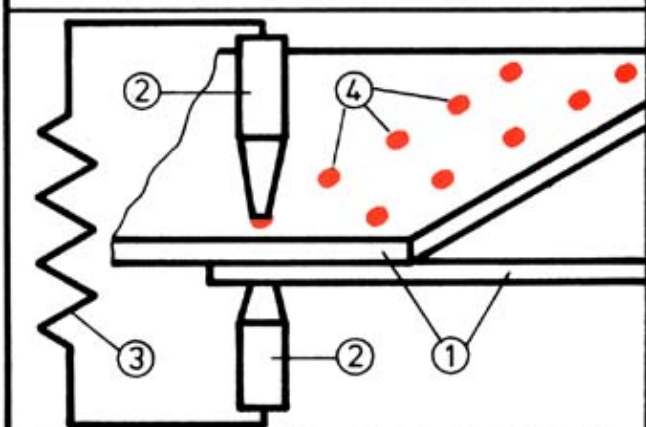
_____ 1.2

①
②
③
④
⑤



_____ 1.3

①
②
③
④
⑤

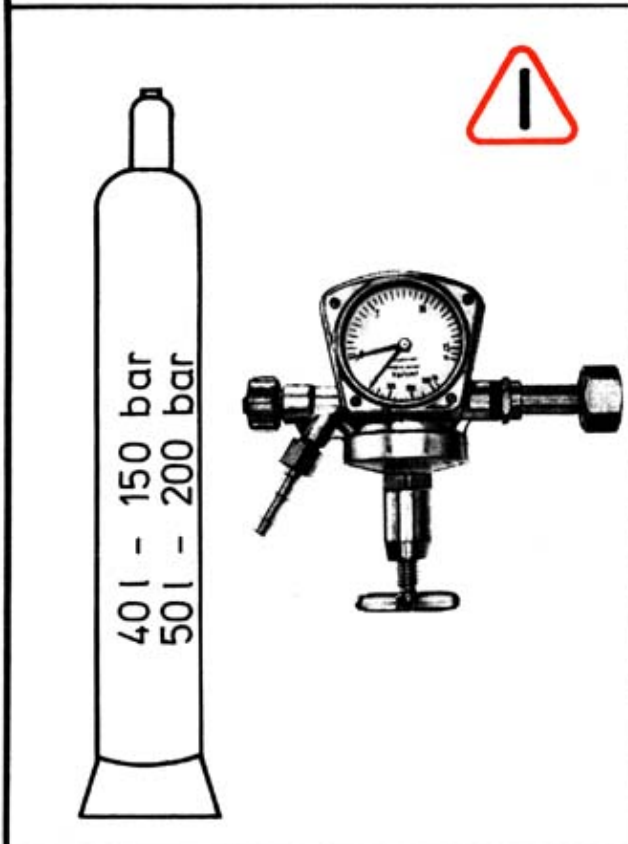
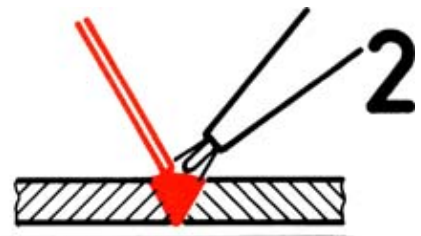


_____ 1.4

①
②
③
④

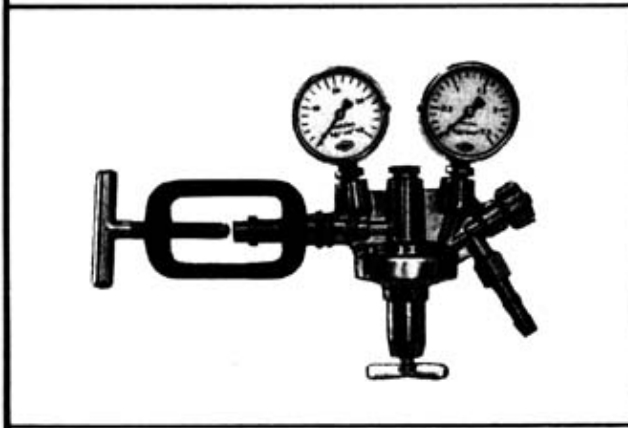


_____ 1.5

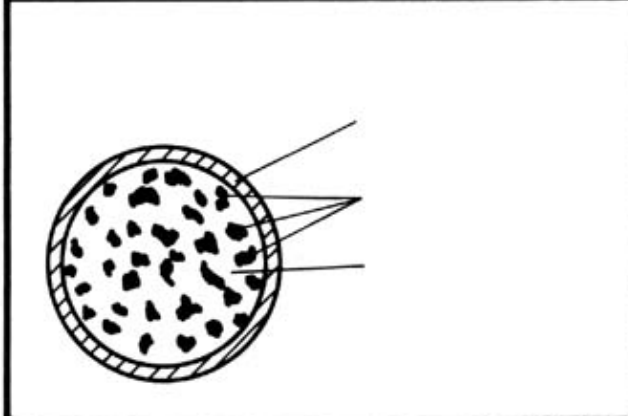


_____ 2.1
 O_2^-

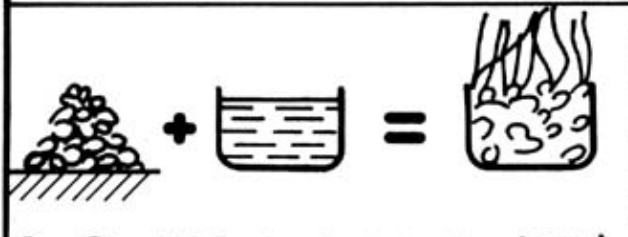
_____ 2.2
 H_2^-



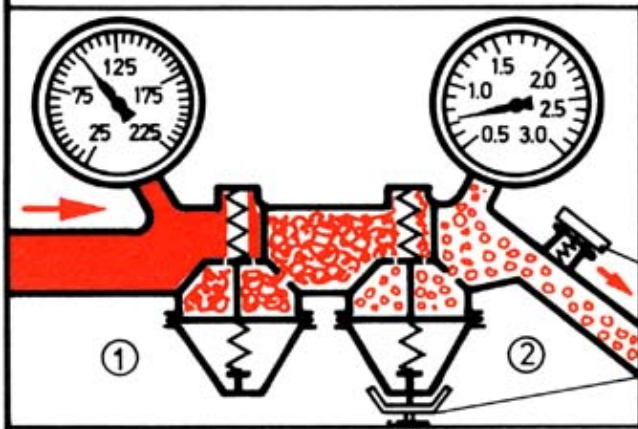
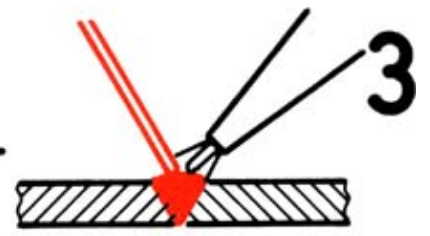
_____ 2.3
 $C_2H_2^-$



_____ 2.4
 $C_2H_2^-$
⚠



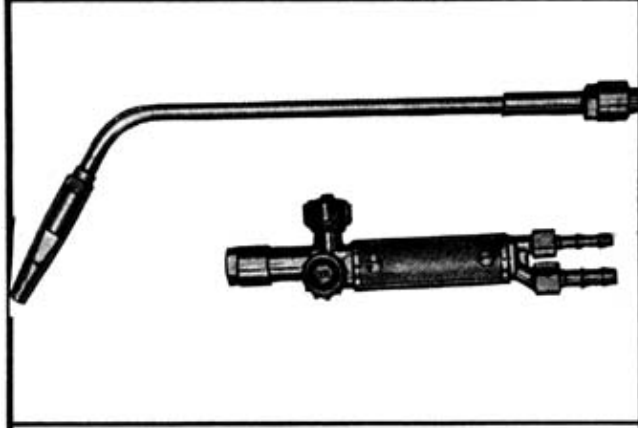
_____ 2.5
⚠



_____ 3.1

① _____

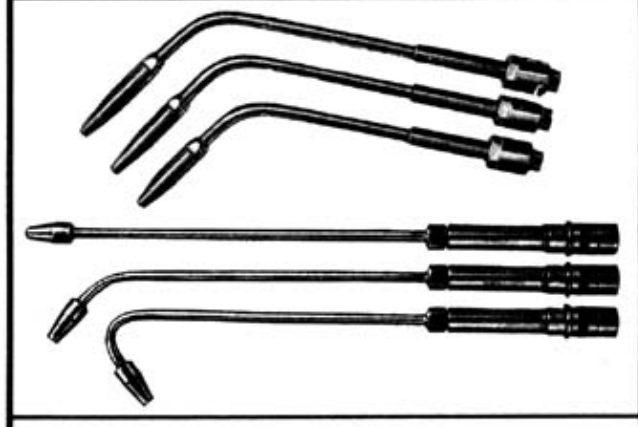
② _____



_____ 3.2

① _____

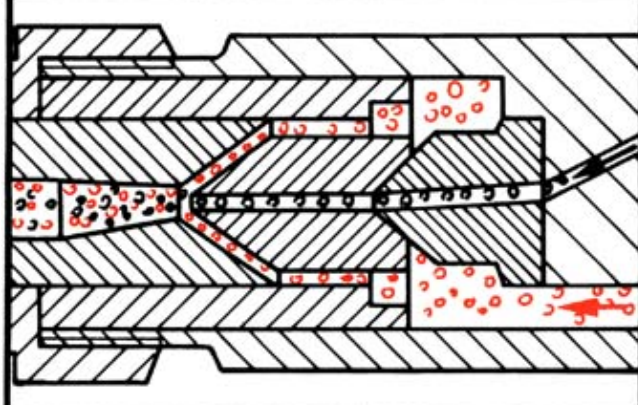
② _____



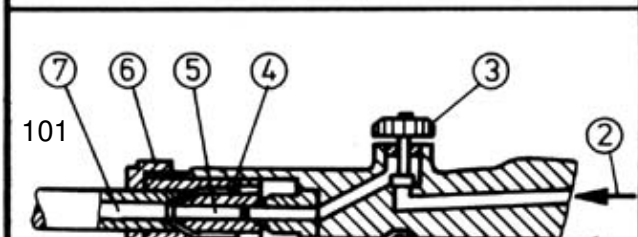
_____ 3.3

① _____

② _____



_____ 3.4

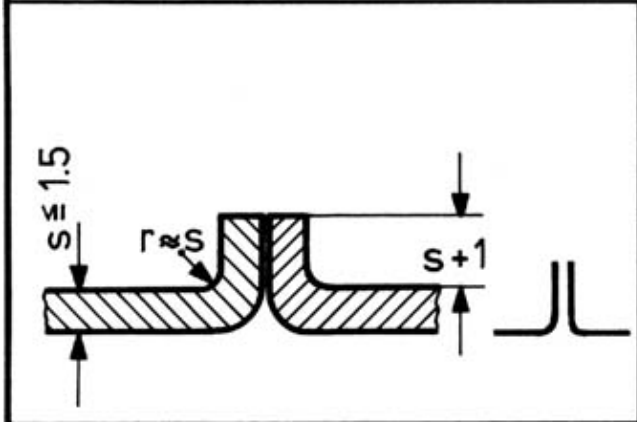
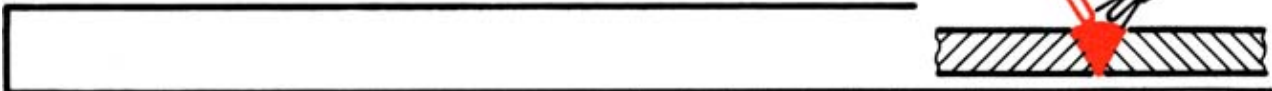
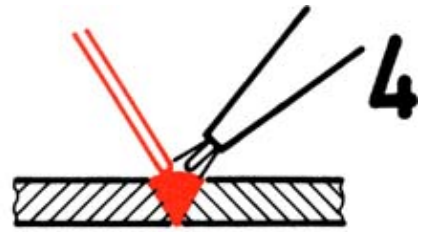


_____ 3.5

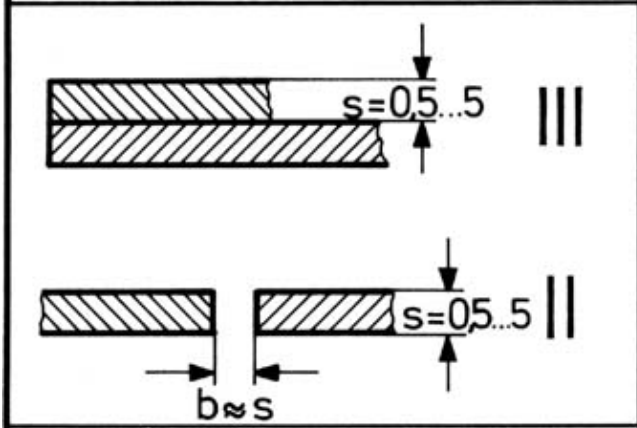
① _____

② _____

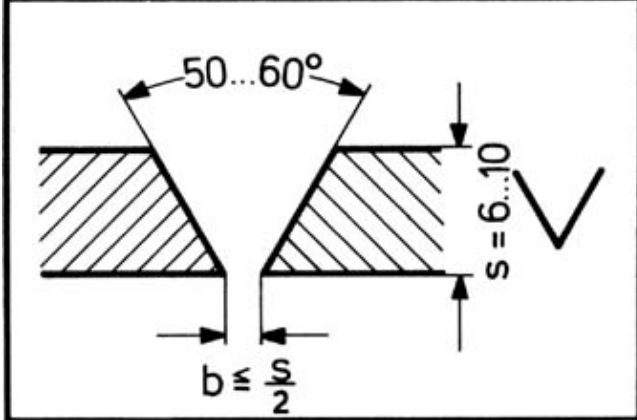
③ _____



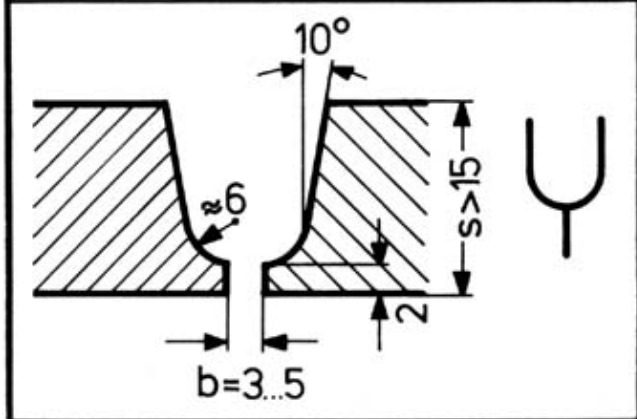
_____ 4.1



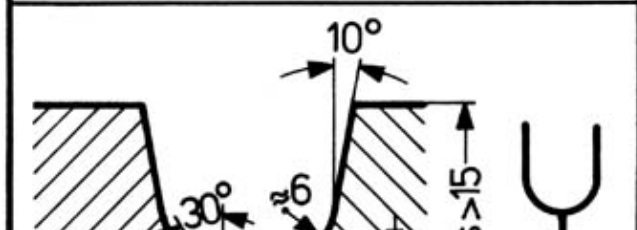
_____ 4.2



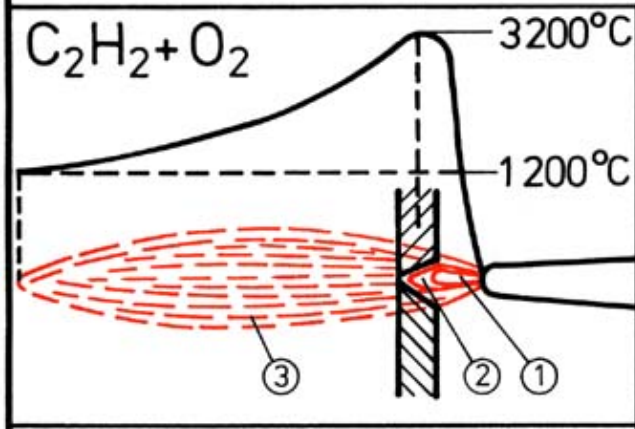
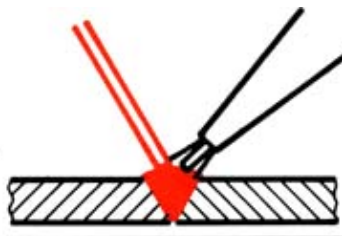
_____ 4.3



_____ 4.4



_____ 4.5

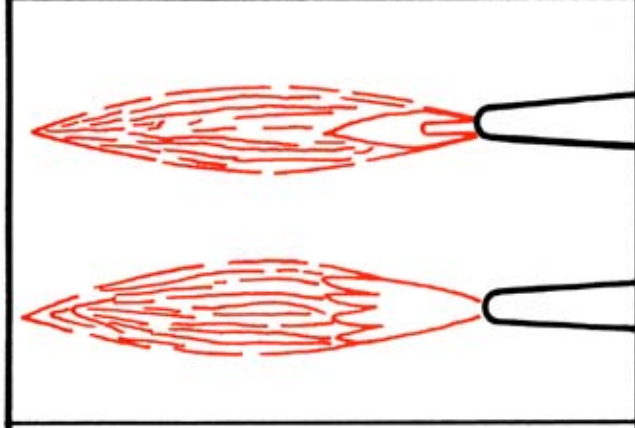


_____ 5.1

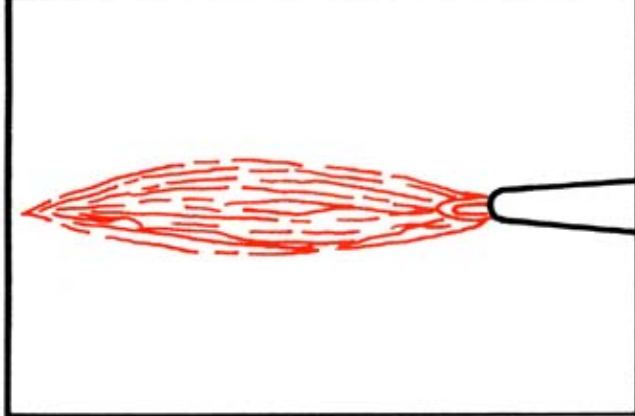
①

②

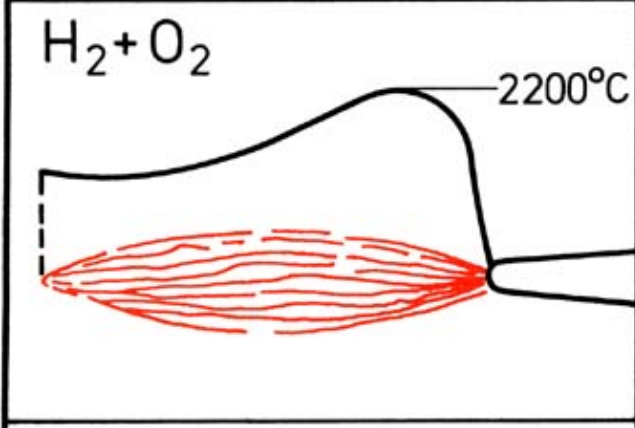
③



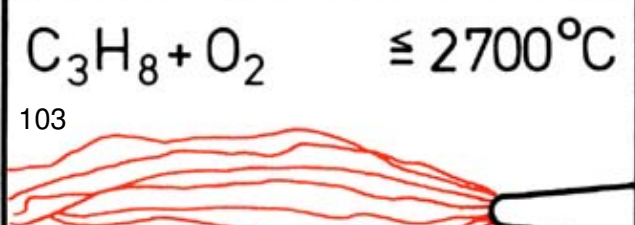
_____ 5.2



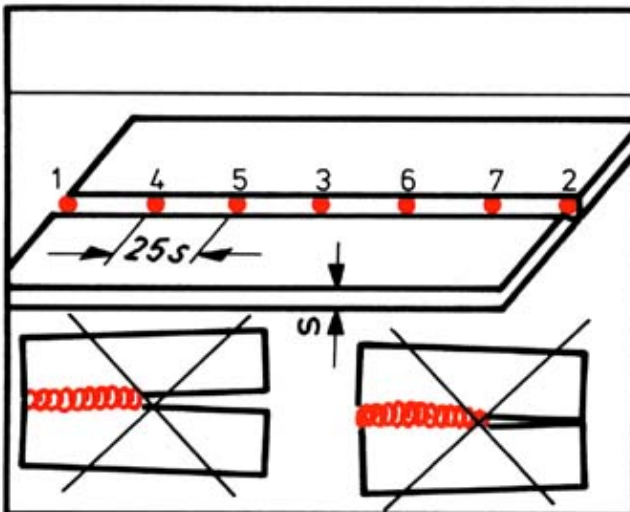
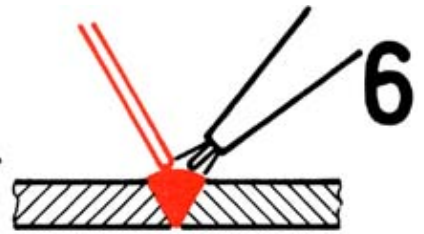
_____ 5.3



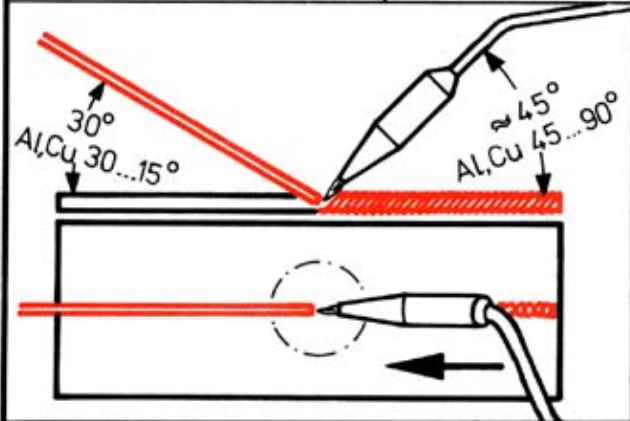
_____ 5.4



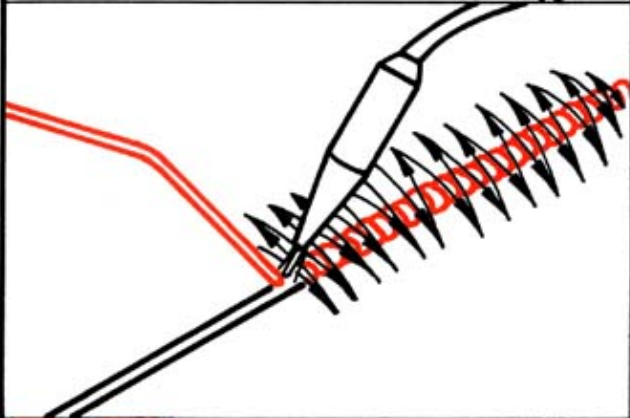
_____ 5.5



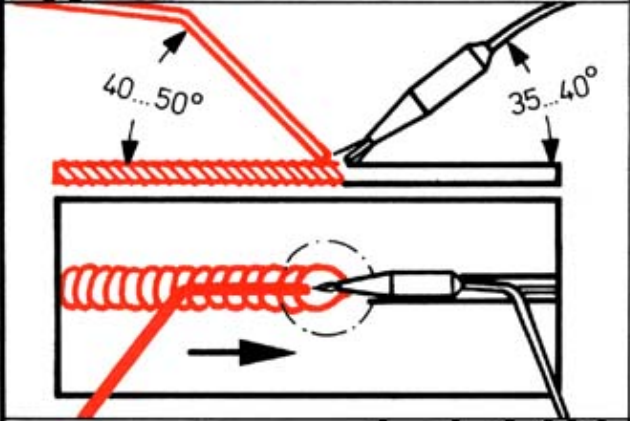
_____ 6.1



_____ 6.2



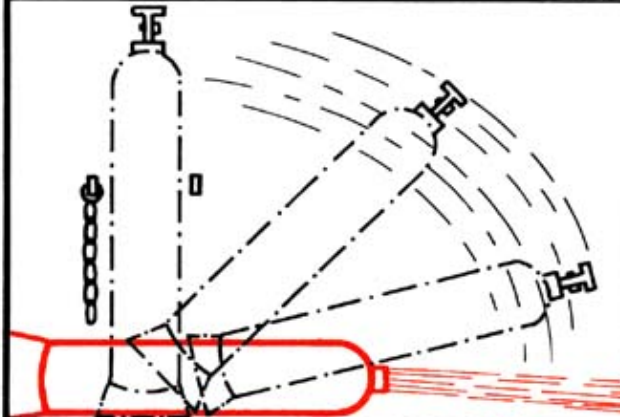
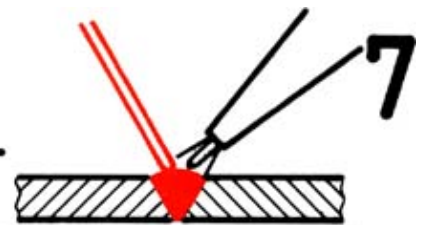
_____ 6.3



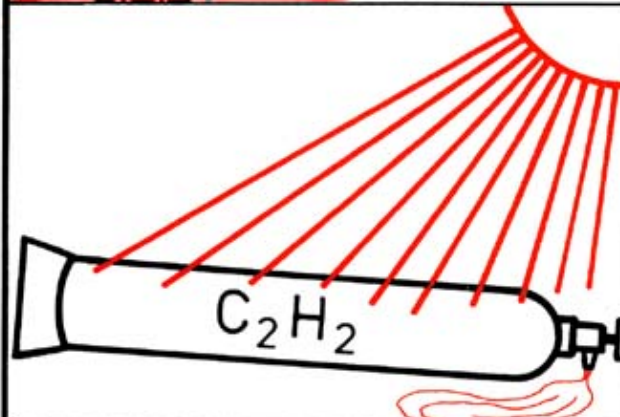
_____ 6.4



_____ 6.5



7.1



7.2



7.3



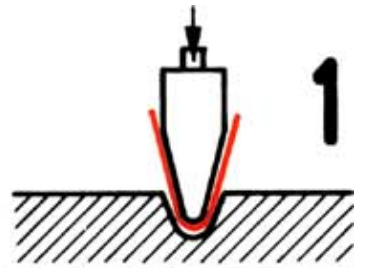
7.4



7.5



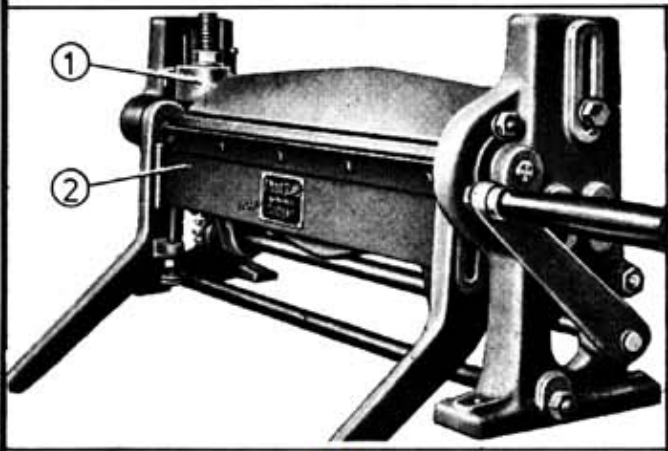
16. Folding/Bending – Umformen/Biegen



	<p>_____ 1.1</p>
	<p>_____ 1.2</p>
	<p>_____ 1.3</p>
	<p>_____ 1.4</p>
	<p>_____ 1.5</p>

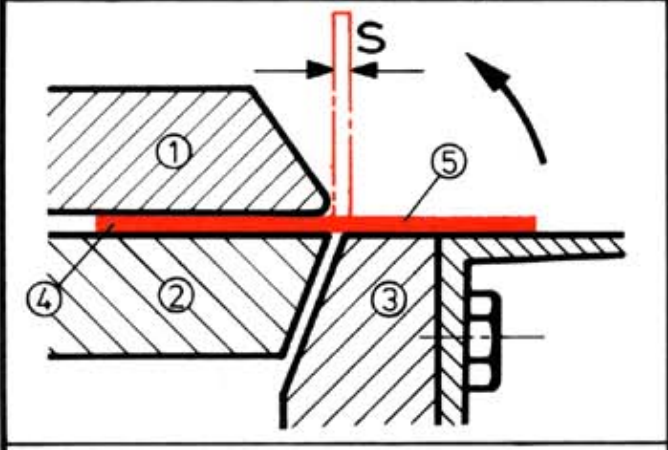


2



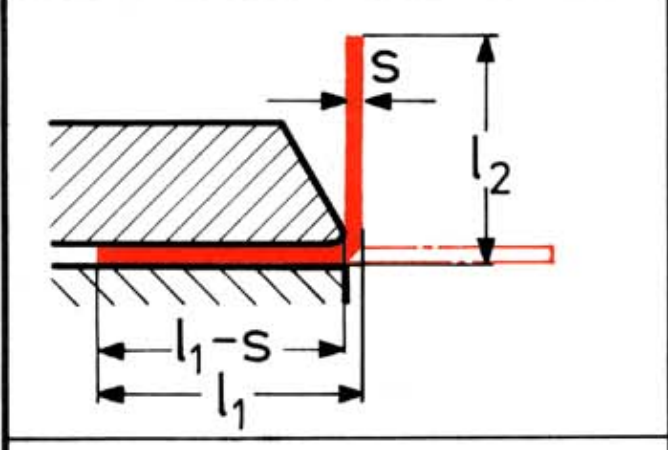
1.2

- ①
- ②

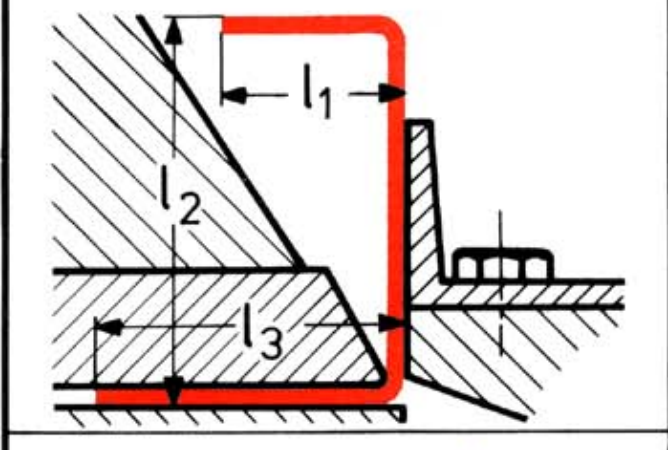


2.2

- ①
- ②
- ③
- ④
- ⑤



2.3

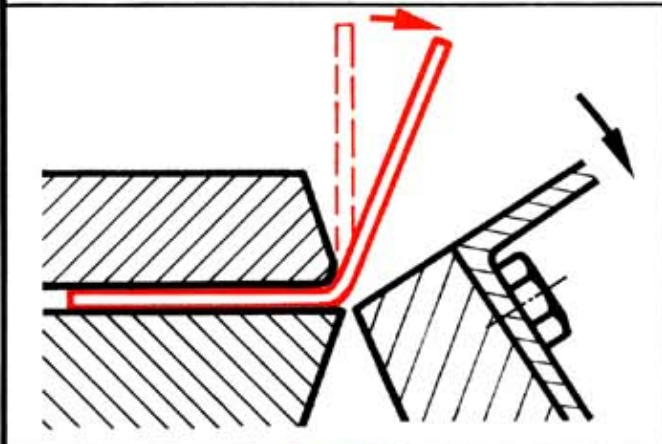
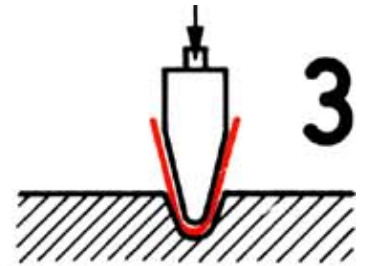


2.4

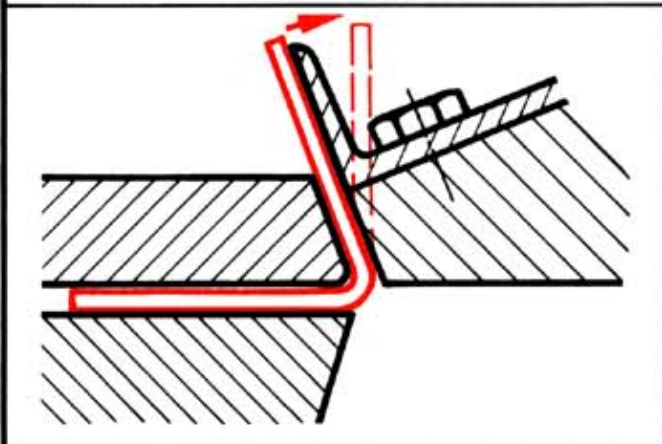


2.5

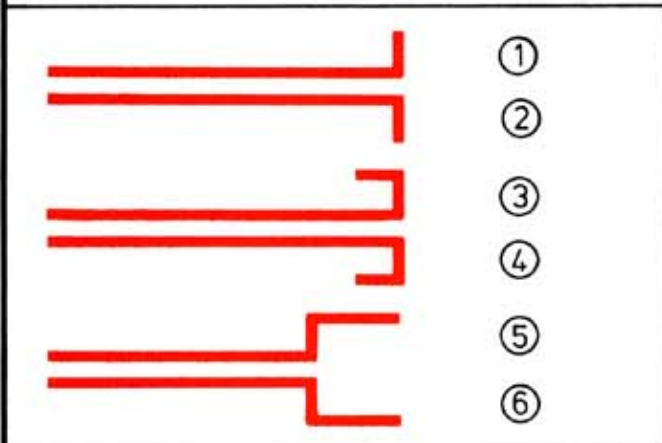
3



3.1



3.2



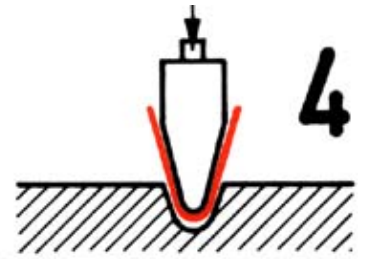
3.3



3.4



3.5

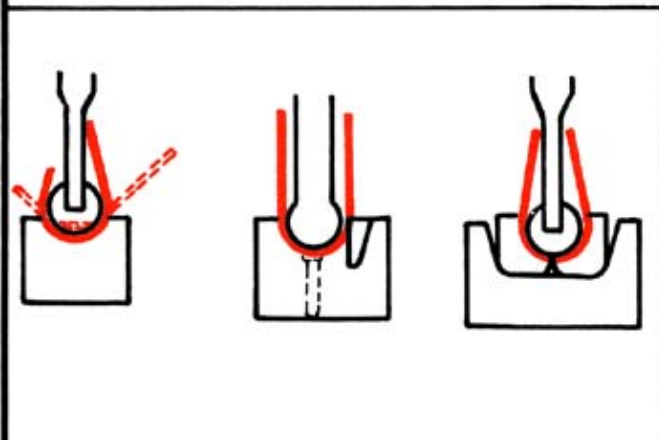


4

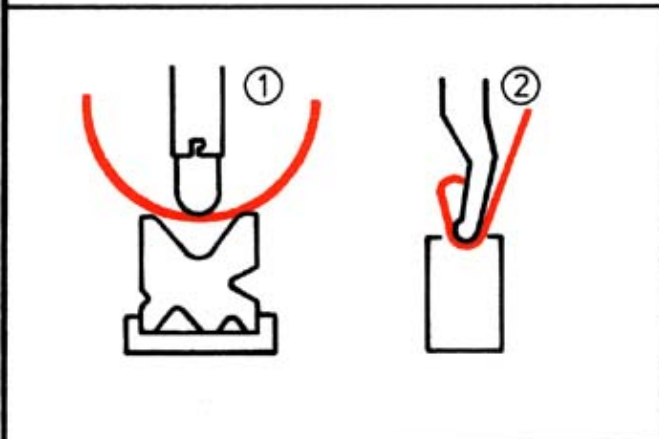
	<p>_____ 4.1</p> <p>①</p> <p>②</p>
	<p>_____ 4.2</p>
	<p>_____ 4.3</p>
	<p>_____ 4.4</p>
	<p>_____ 4.5</p>



5

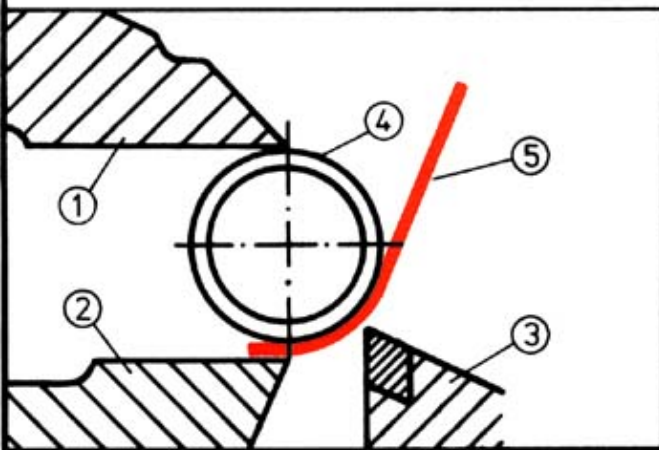


5.1



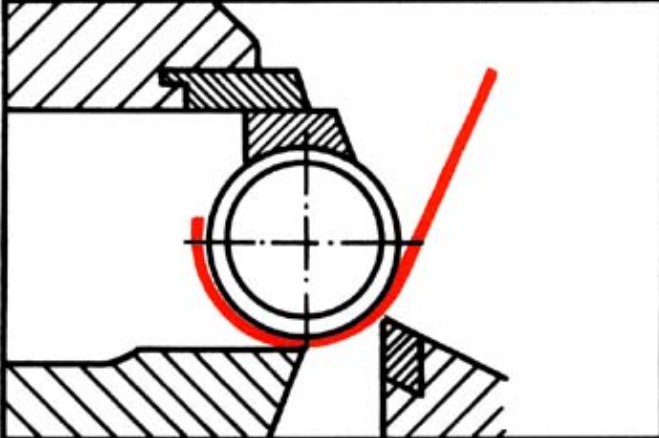
5.2

- ①
- ②



5.3

- ①
- ②
- ③
- ④
- ⑤



5.4



5.5



6

	<p>_____ 6.1</p>
	<p>_____ 6.2</p>
	<p>_____ 6.3</p>
	<p>_____ 6.4</p>
	<p>_____ 6.5</p>