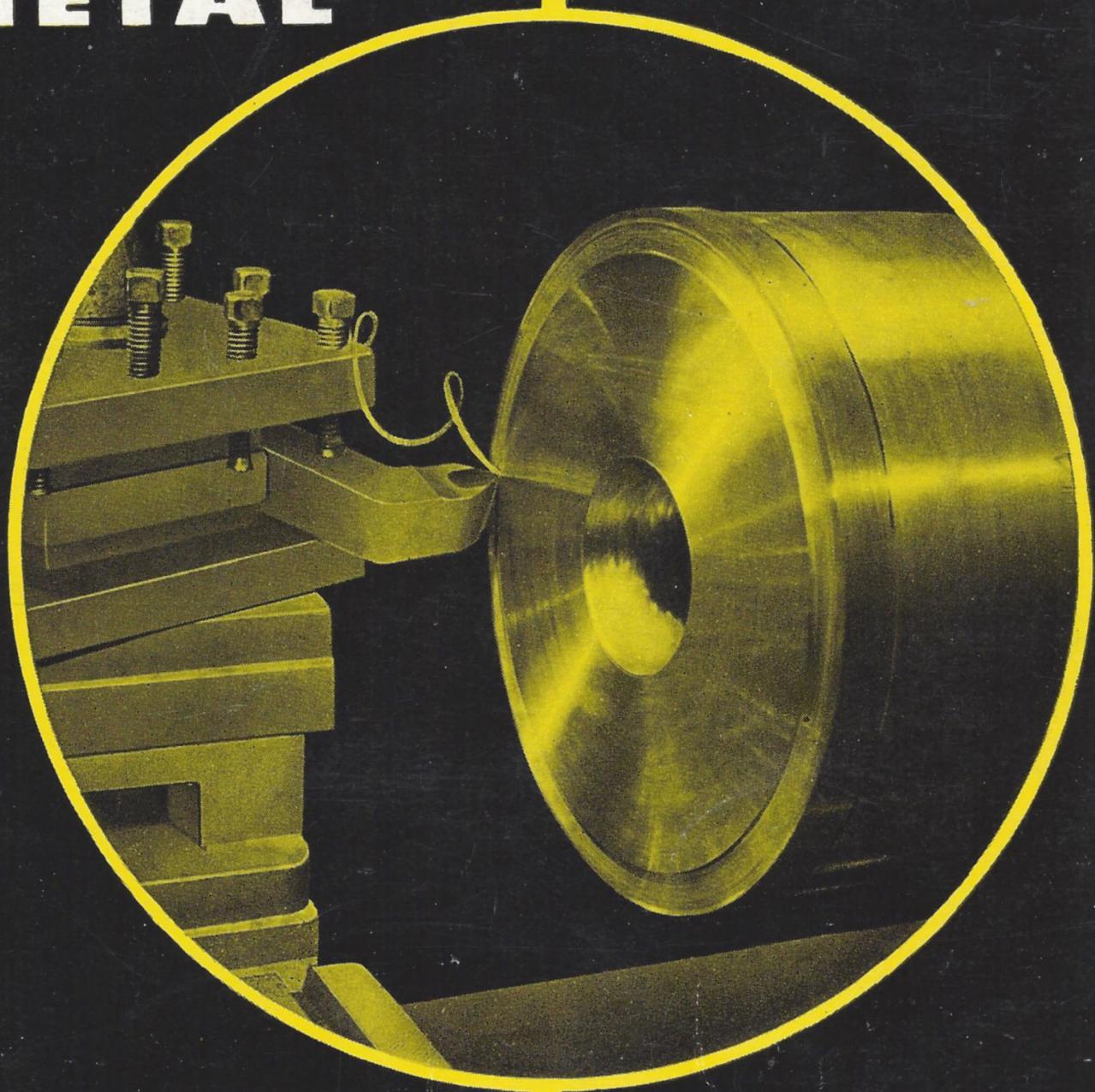


VELEBIT HARD METAL



METAL • MANUFACTURERS OF HARD METAL »VELEBIT« ZAGREB (YUGOSLAVIA)

VELEBIT HARD METAL



• METAL •
MANUFACTURERS OF HARD METAL »VELEBIT«

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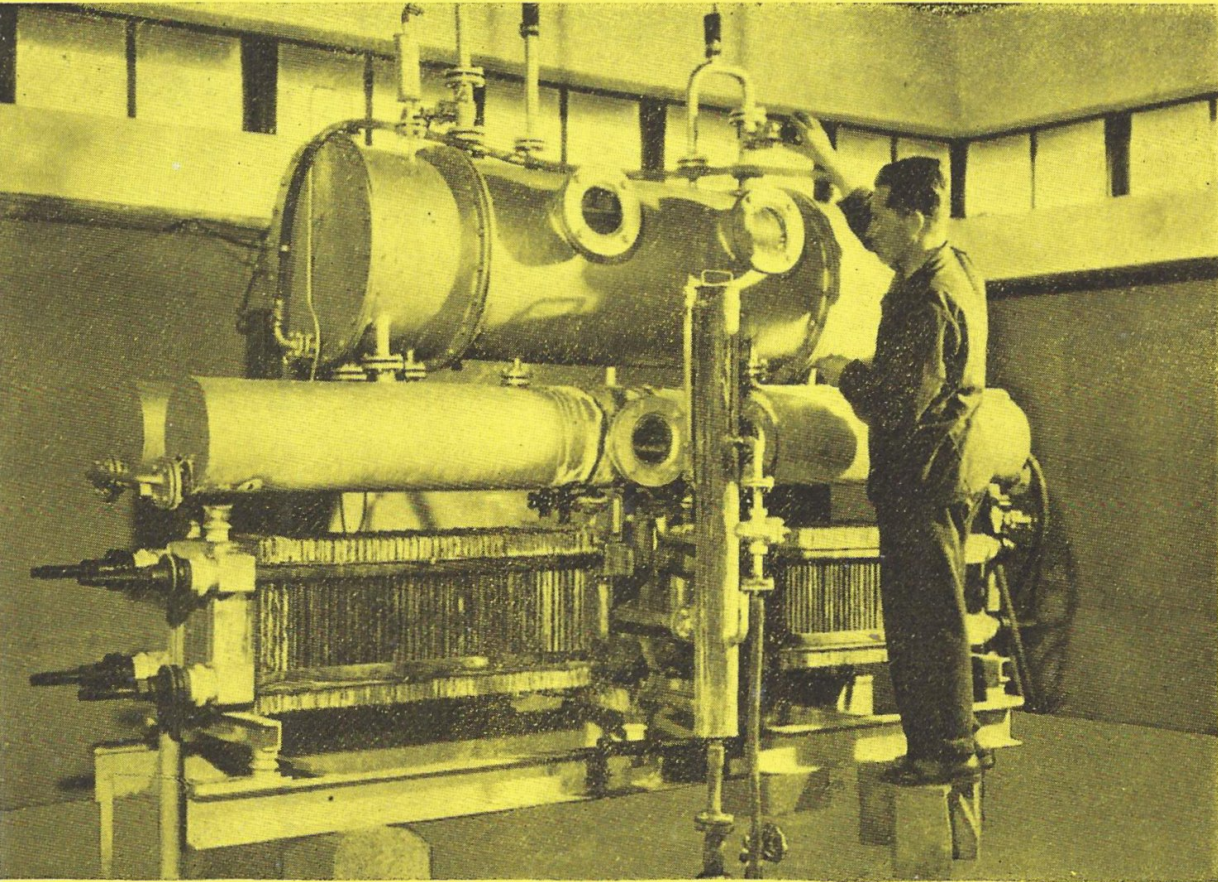
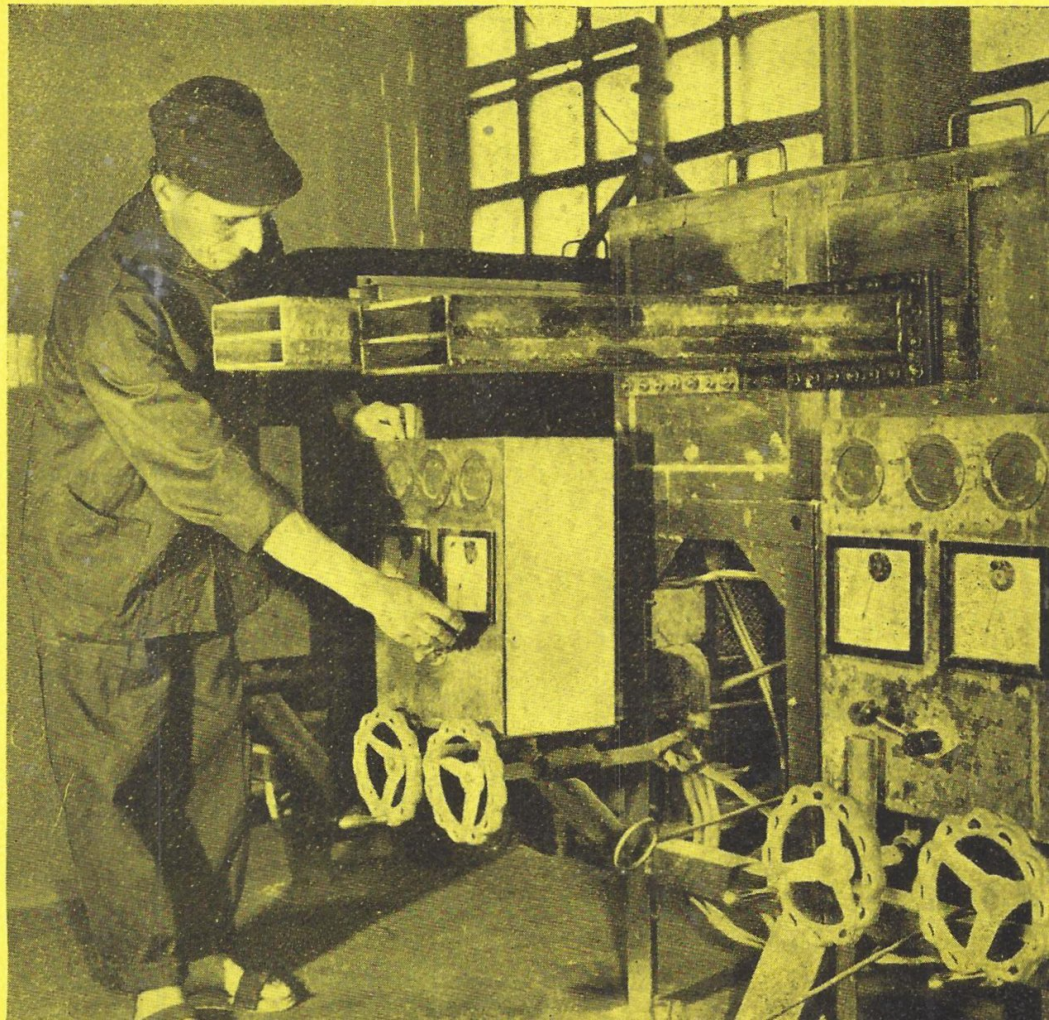
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P R E F A C E

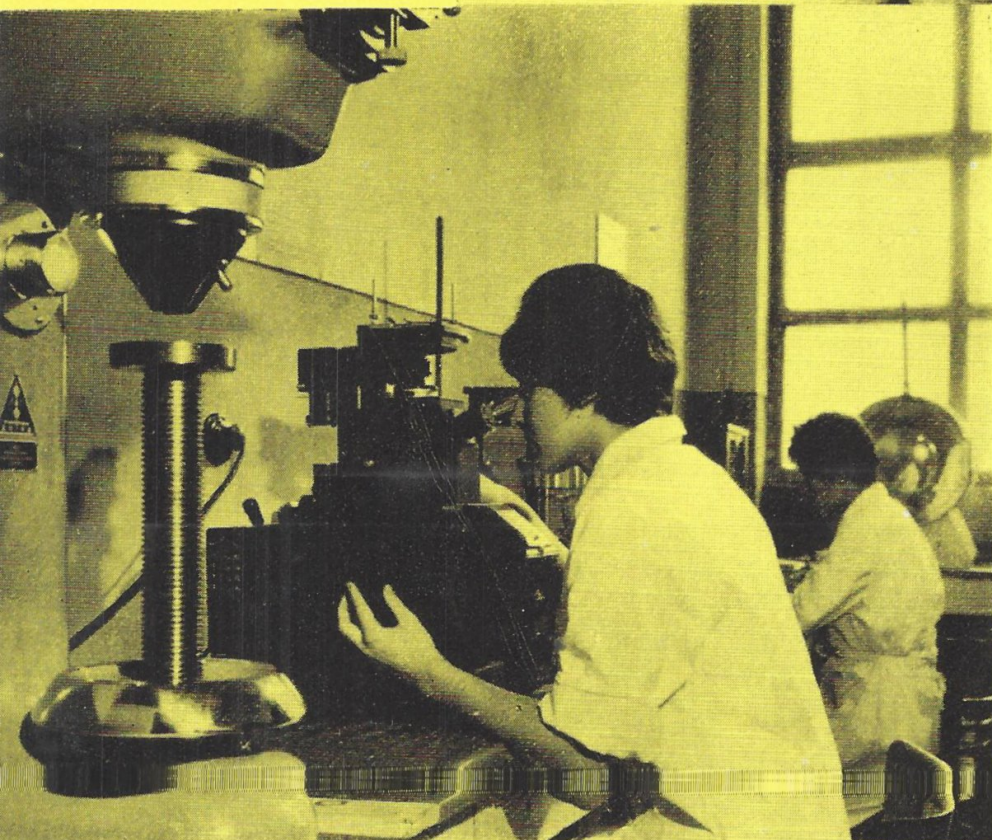
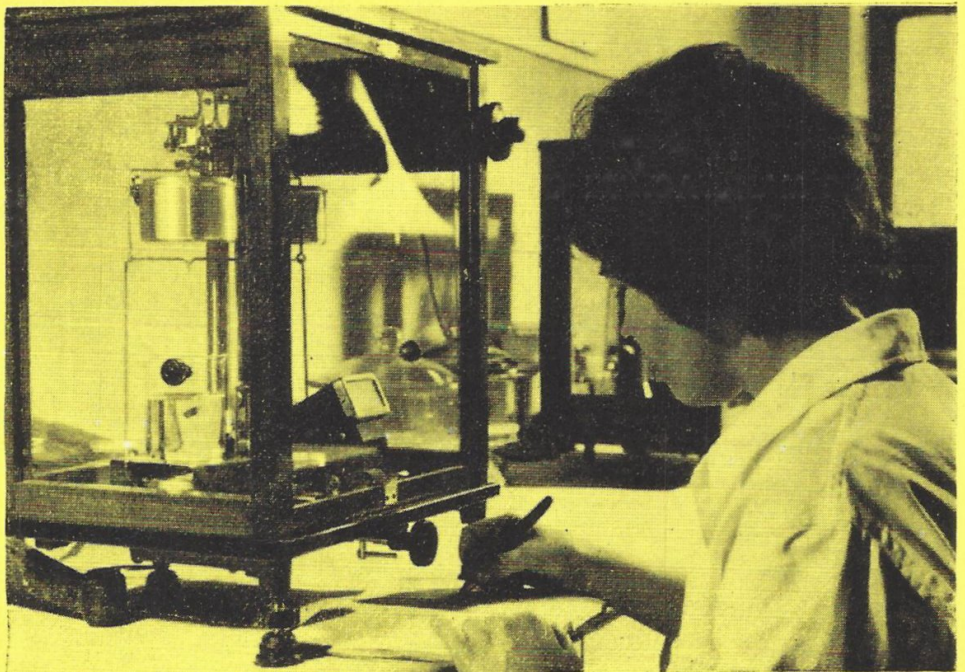
Owing to the theoretical and experimental achievement by their researches in the field of powder metallurgy, the »Metal« works in Zagreb are setting out as manufacturers and exporters of first-class quality hard metal. The hard metal with the »Velebit« trade mark obtained high awards at many international exhibitions. It was for its extraordinary strength and special qualities of cutting that the hard metal »Velebit« soon occupied a dominant position, and the demand for it is increasing every day. In order to satisfy the steadily increasing demand on local and foreign markets, we were forced to enlarge our plant to a wide extent. Our works are equipped with the most up-to-date machinery and appliances. With regard to the large assortment of grades and shapes we found it necessary to issue a catalogue in the form of a professional manual. Composing this catalogue we wished to inform our customers in the most comprehensible manner how to use the hard metal »Velebit«. For this reason special instructions have been compiled showing the grades of the hard metal and the most effective way of its use. Special tables of angles, informations how to make and use cutting tools, the way of brazing tool tips, and some mostly needed features have been added. Our main object was to refer to the principal problems as basis of information to every direct customer.

First, this catalogue comprises all existing Yugoslav standards (JUS), the international standards (ISO) as far as they are known to us, and in the absence of JUS and ISO, in most of the cases, we used the German standards DIN.

FROM THE MANUFACTURE OF HARD METAL

PRODUCTION
OF HYDROGENOVENS FOR
THE REDUCTION
OF WO_3 

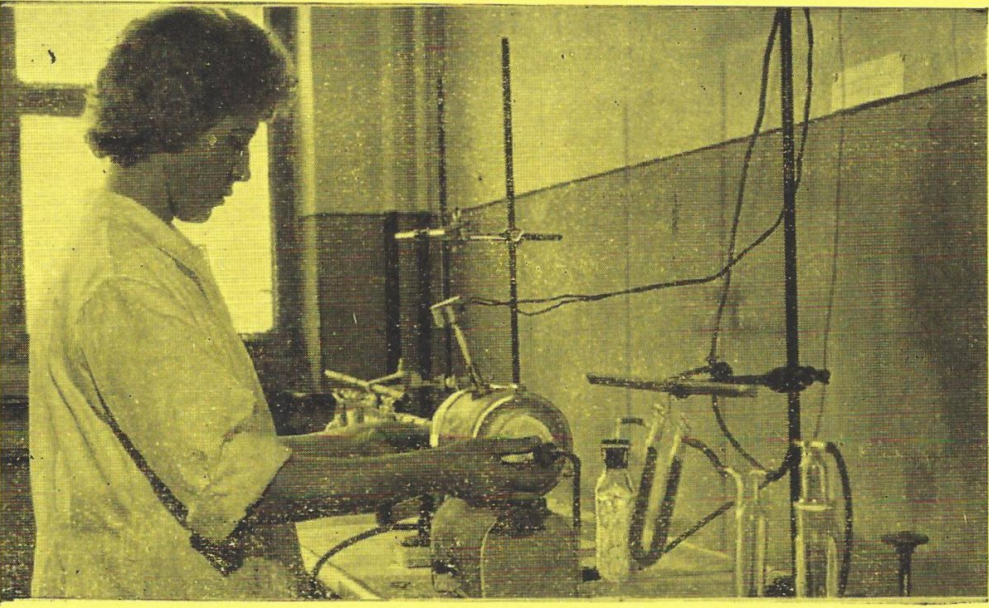
DETERMINATION
OF SPECIFIC
GRAVITY



EXAMINATION OF POROSITY
AND MICROSTRUCTURE

HARDNESS TESTING

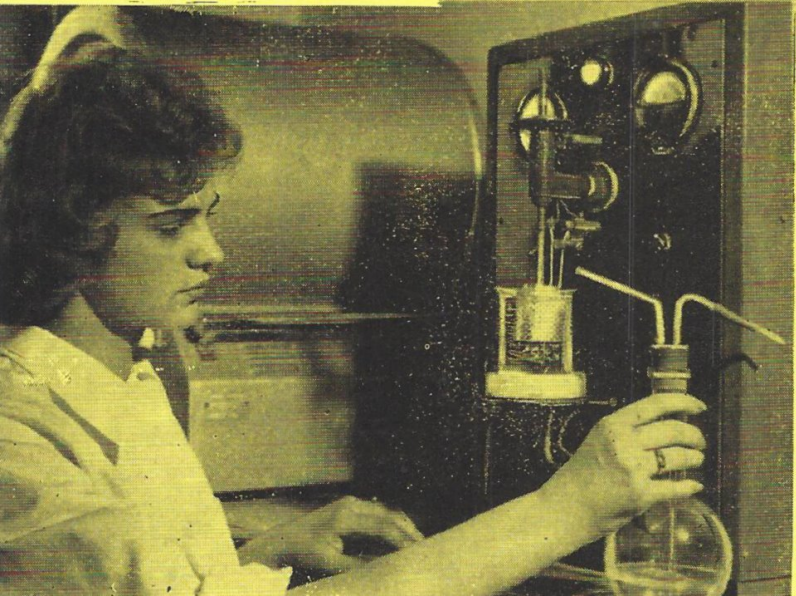




DETERMINATION
OF TOTAL CARBON



CONTROL OF
CONTENT
OF TITANIUM



ELECTROLYSIS
OF COBALT

THE HARD METAL »VELEBIT« AND ITS USE

The hard metal »Velebit« is made of carbides of rare elements such as Tungsten, Titanium, Vanadium, and others. These elements have outstanding specific chemo-physical properties. As to its aspect the hard metal is similar to steel, but there is a fundamental difference between them. Whereas steel is alloyed iron, there is no trace of iron in a hard metal. Steel is obtained by fusion of molten matter, but a hard metal is formed by joining solid particles at high temperatures by means of some binder such as for instance Cobalt, Nickel, and others. The hard metal »Velebit« excels by its extraordinarily high hardness and the corresponding tenacity, when other high-speed steels can no longer be used. The hardness of the hard metal »Velebit« being very high, it can be neither forged nor hardened. It takes its shape while being produced. Later machining is possible with the help of special grinding wheels only. Nowadays, an electro-erosive process is in use, also. It must be pointed out particularly that the conductivity of heat varies considerably for various grades of hard metal. Hence attention must be drawn to the necessity of special care when grinding a hard metal in order to avoid cracks as a certain result of local overheating. The usability of hard metal is versatile. Everything depends on the material to be machined.

THE GRADES OF »VELEBIT« TOOL TIPS

The entire production of the hard metal »Velebit« is divided into 16 grades in order to enable the selection of the most suitable grade of »Velebit« tool tips according to the material to be machined and the other conditions.

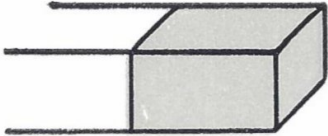

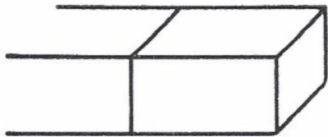
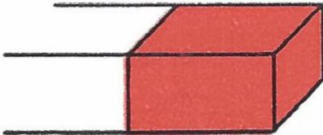
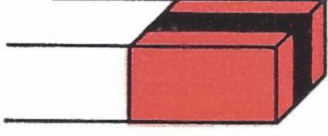
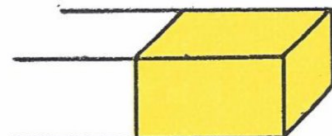


Owing to certain common properties these 16 grades may be classed in 3 groups. In group I are the grades as under: F1, S1, S2, S3, and S4. This group with its properties is characteristic inasmuch as it is mainly of a long-chipping nature.

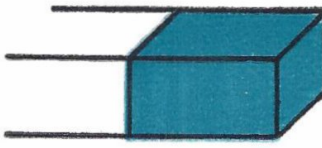
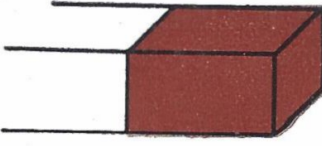
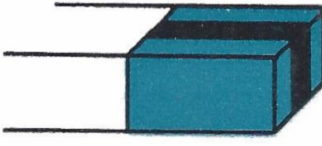
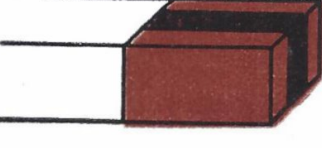

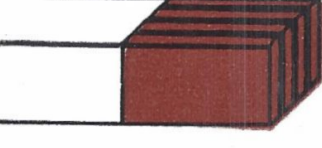

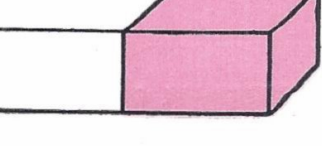
Group II comprises the grades as under: H1, H2, H3, G1, G2, G3, G4, G5, and G6. The hard metal of this grade is suitable for machining gray and hard castings, i. e. material of a short-chipping nature, for machining synthetic plastics, and for all other material.

Group III is composed of a group which, according to its features, may be called universal. The hard metal of grade U1, U2, in case of medium demands, can be used for machining steel and cast iron. The following separate treatises shortly state the domain of use for each grade.

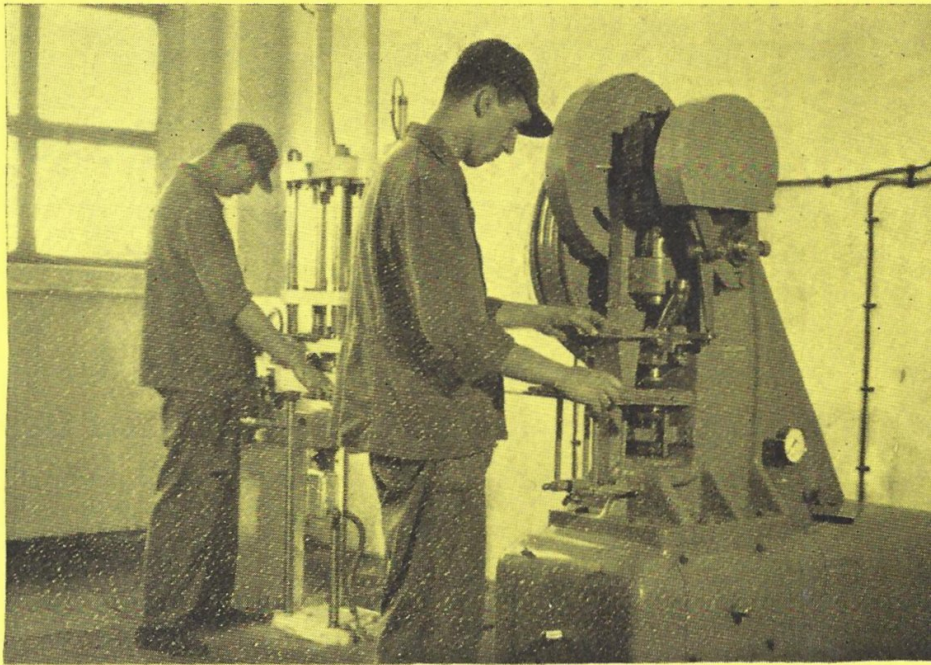
In the case of doubt or in cases not determined sufficiently, it is in the interest of the customer, when asking for information or placing an order, to give exact particulars as to the kind and strength of the material which is to be machined, and to describe the conditions of the intended operation. For cases of special work, the grade can be best fixed on on base of expert experience. In such cases our customer may apply to our technical service.

TABLE SHOWING THE USABILITY OF GRADES OF HARD METAL »VELEBIT«

Symbol	Usability	Colour of shank
F1	For finishing cuts and boring steel, i. e. for machining with small feed motions at great speeds with low power.	
S1	For turning and milling steel and cast steel at high speeds and small or medium feed motions.	
S2	For turning and milling steel and cast steel at medium feed motions, and at medium cutting speeds by 35 per cent, less than stated in the case of use of S1.	
S3	For turning and milling steel and cast steel at low and medium speeds of cutting at very great feed motions, and especially suitable for operations with slots.	
S4	For use in cases when a greater toughness than S3 is required, and in cases where there was used hitherto high-speed steel. It is used at low cutting speeds and great feed motions.	
H1	For turning and milling cast iron of great hardness, glass, bronze, porcelain, alloyed light metals, synthetic plastics, and malleable cast iron.	
H2	For turning and milling particularly hard castings and for machining special light metal alloys.	
H3	For turning and milling synthetic material and for machining ceramics, non-metals and various pressed material.	

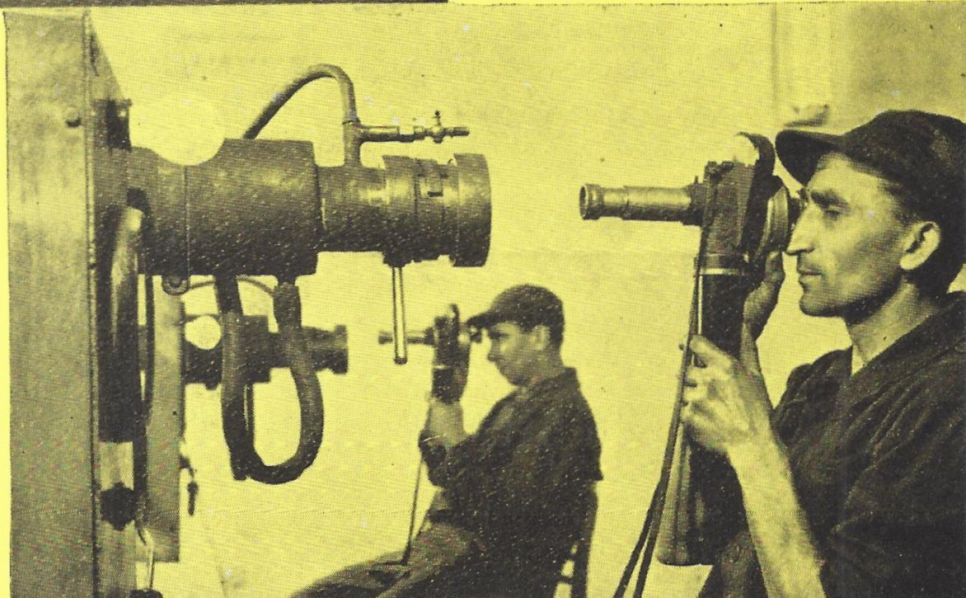
Symbol	Usability	Colour of shank
G 1	For turning and milling cast iron, coloured metals, plastics, and various pressed material.	 A 3D perspective drawing of a rectangular shank with a blue face, mounted on a lathe with three visible tool bits.
G 2	For turning and milling wood of various fibrous substances, and for percussory mining tools.	 A 3D perspective drawing of a rectangular shank with a red face, mounted on a lathe with three visible tool bits.
G 3	For the production of tools for deep extraction, and for various tools for presses, and also for wood in special cases.	 A 3D perspective drawing of a rectangular shank with a blue face, mounted on a lathe with three visible tool bits.
G 4	Hard metal of this grade is suitable for the manufacture of various tools for cold and hot shock-forming when toughness is required.	 A 3D perspective drawing of a rectangular shank with a red face, mounted on a lathe with three visible tool bits.
G 5	Hard metal of this grade is suitable for the manufacture of various tools for cold and hot shock-forming when high toughness is required.	 A 3D perspective drawing of a rectangular shank with a red face, mounted on a lathe with three visible tool bits.
G 6	Hard metal of this grade is suitable for the manufacture of various tools for cold and hot shock-forming when extremely high toughness is required.	 A 3D perspective drawing of a rectangular shank with a red face, mounted on a lathe with three visible tool bits.
U 1	Universal grade for turning and milling gray iron and other materials of a short-chipping nature, and for steel and cast steel with high cutting speeds and medium requirements as to toughness.	 A 3D perspective drawing of a rectangular shank with a purple face, mounted on a lathe with three visible tool bits.
U 2	Universal grade for turning, milling, and planing steel and cast steel, grey iron and other material of a short-chipping nature with medium cutting speeds and great requirements as to toughness.	 A 3D perspective drawing of a rectangular shank with a pink face, mounted on a lathe with three visible tool bits.

**AUTOMATIC PRESS
FOR THE PRODUCTION
OF HARD METAL**

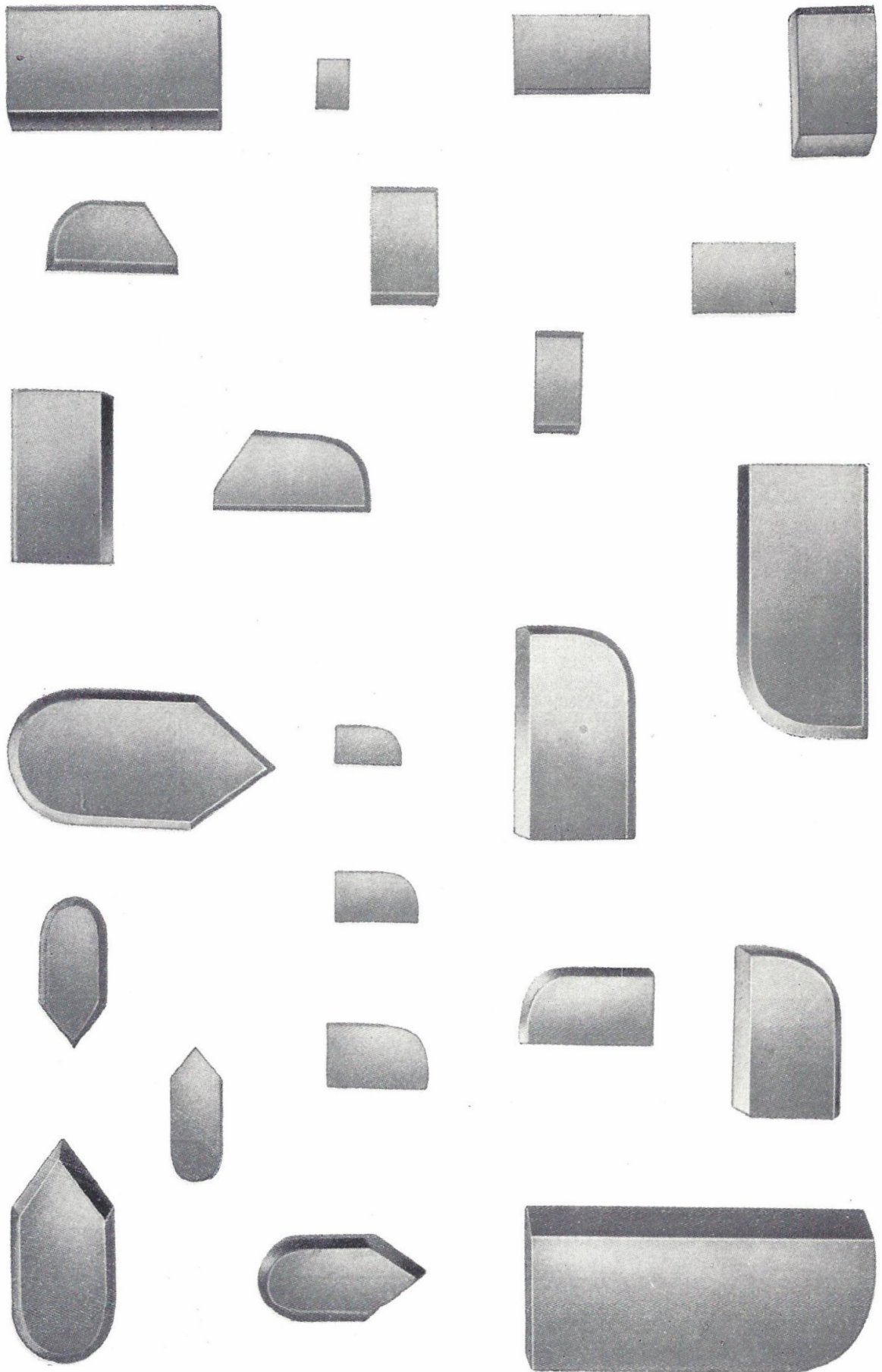


**THE CUTTING
OF SPECIAL SHAPES
OF HARD METAL**

**TEMPERATURE CONTROL
OF CALCINING FURNACES**

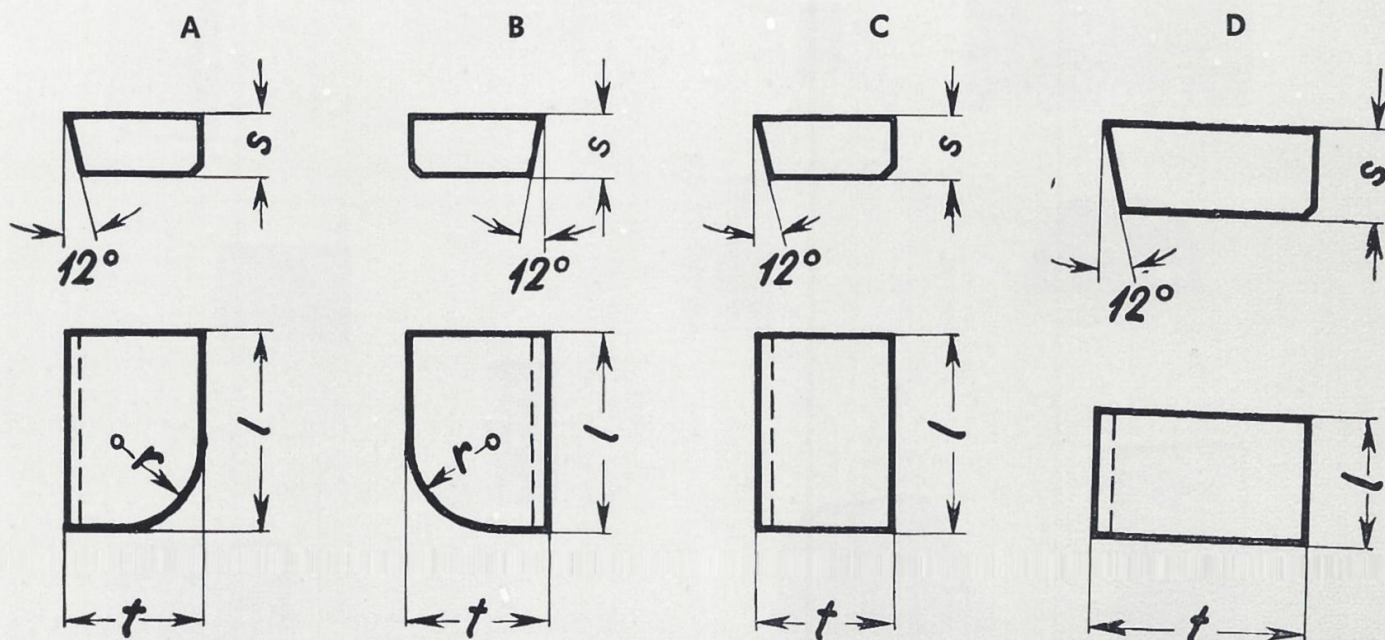


STANDARD SHAPES OF CEMENTED CARBIDE TOOLS



»VELEBIT« TOOL TIPS JUS K. C1. 151 (DIN 4966/II.)

Dimensions in mm



Tip edges may be slightly chamfered.

L	Shape A, B and C			Shape D	
	t	s	r	t	s
3				7	2
4				8	3
5				10	4
6				12	5
8				14	6
10				17	8
12				20	10
20	12	6	8		
25	14	7	8		
32	16	8	10		
40	18	10	10		
50	20	12	12		

NOTE: Dimensions of chamfered edge of tip $\approx 1/6 s$.

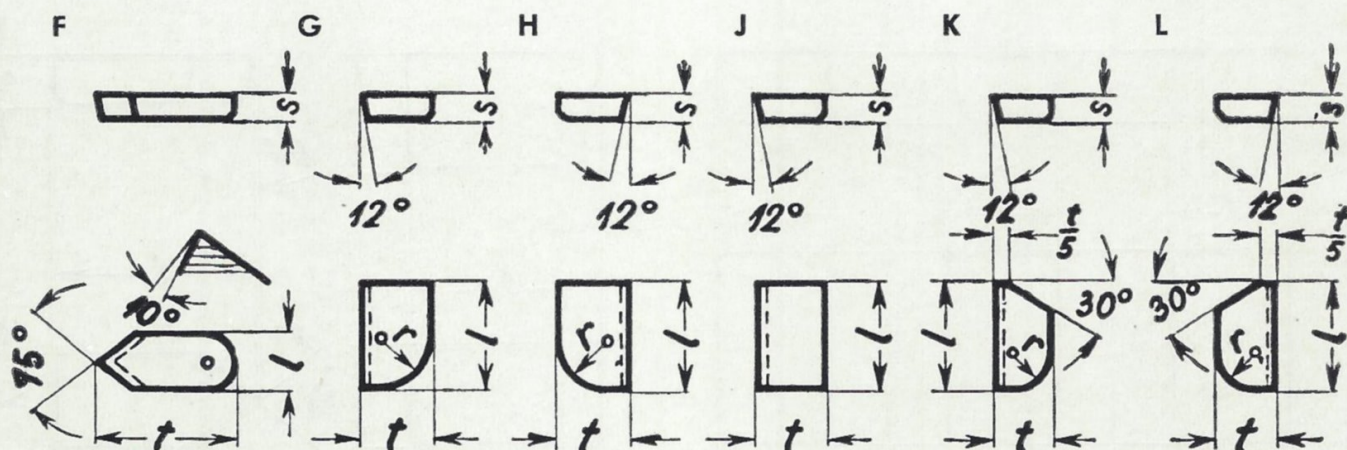
Tips to $s = 3$ mm inclusively are made without chamfered edge and without clearance angle.

»VELEBIT« TOOL TIPS

JUS K. C 1. 150

DIN 4966/II.

Dimensions in mm



Tip edges may be slightly chamfered.

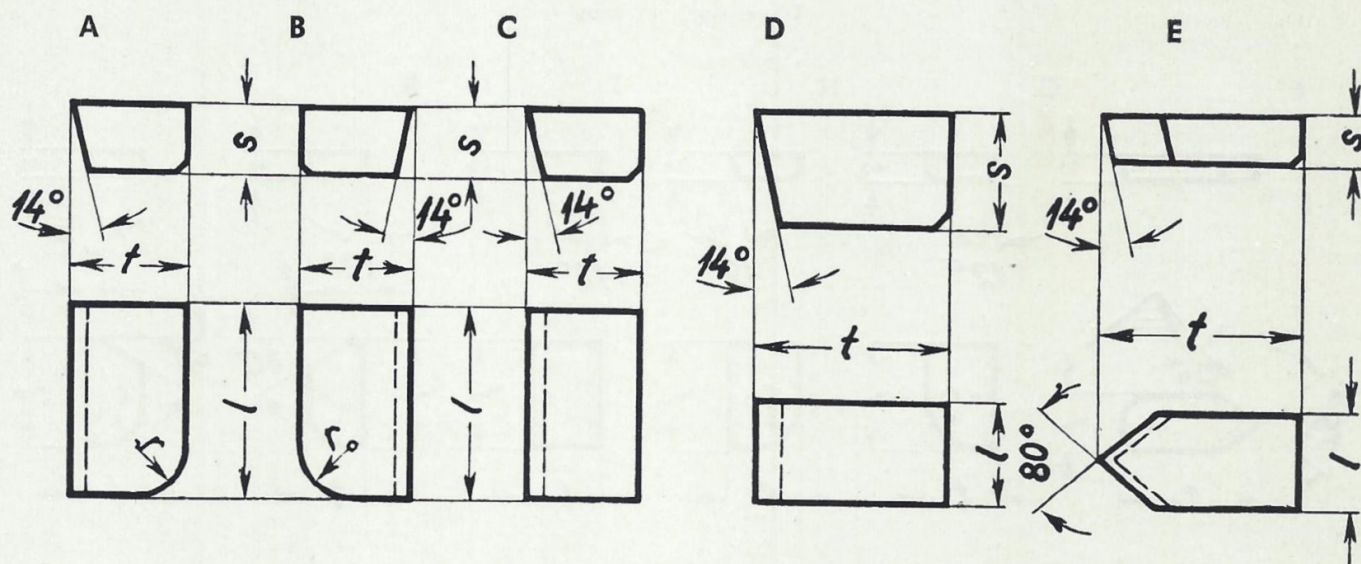
L	Shape F		Shape G, H, and J			Shape K and L		
	t	s	t	s	r	t	s	r
4	12	2						
5	14	2,5						
6	16	3	4	2	2			
8	18	4	5	2	3	4	2	3
10	20	5	6	2,5	4	5	2,5	3
12	25	6	8	3	5	6	3	4
16			10	4	6	8	4	5
20						10	5	6

NOTE: Dimensions of chamfered tip $\approx 1/6 s$.Tips to $s = 3$ mm inclusively are made without chamfer and without clearance angle.

»VELEBIT« TOOL TIPS

ISO
DIN 4950

Dimensions in mm



Tip edges may be slightly chamfered

Length	Shape A, B and C			Shape D		Shape E	
	t	s	r	t	s	t	s
3				8	3		
4				10	4	10	2,5
5	3	2	2	12	5	12	3
6	4	2,5	2,5	14	6	14	3,5
8	5	3	3	16	8	16	4
10	6	4	4	18	10	18	5
12	8	5	5	20	12	20	6
16	10	6	6			22	7
20	12	7	7			25	8
25	14	8	8			28	9
32	18	10	10			32	10
40	22	12	12				
50	25	14	14				

NOTE: Tips to $s = 3$ mm inclusively are made without chamfer and without clearance angle.Dimension of chamfered tip $\approx 1/6 s$.

Dimension »l« in case of shape D of tool tip greater by 0,5 mm.

»VELEBIT« TOOL TIPS

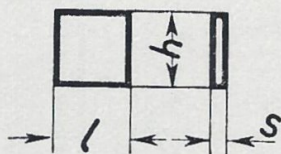
for drills

DIN 8010

Dimensions in mm

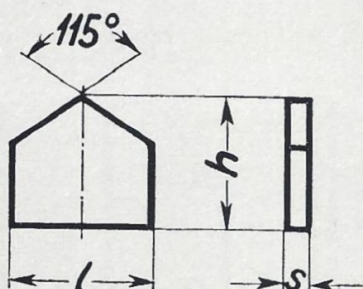
SHAPE A

l = 2 to 4 mm



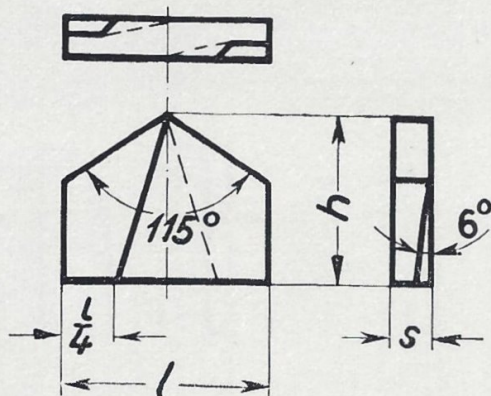
SHAPE B

l = 4,5 to 8 mm



SHAPE C

l = 8,5 to 31,5 mm



Length l	h	s	For drills diameter D
2	3	0,3	1,5
2,5	3,5	0,4	2
3	4	0,5	2,5
3,5	4,5	0,6	3
4	4,5	0,6	3,5
4,5	5	0,9	4
5	5	0,9	4,5
5,5	5,6	0,9	5
6	6	1,4	5,5
6,5	6	1,4	6
7	6,3	1,4	6,5
7,5	6,3	1,6	7
8	7,1	1,6	7,5
8,5	7,1	1,6	8
9	8	2	8,5
9,5	8	2	9
10	8,5	2	9,5
10,8	8,5	2	10
11,3	9,5	2,2	10,5
11,8	9,5	2,2	11

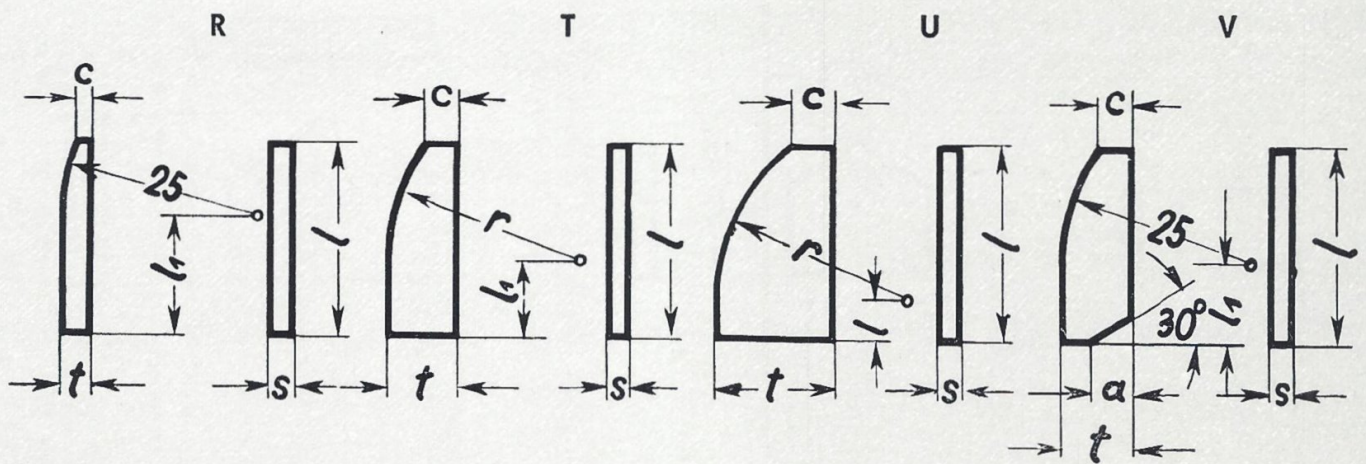
Length l	h	s	For drills diameter D
12,3	10,6	2,5	11,5
12,8	10,6	2,5	12
13,8	12,5	2,5	13
14,8	12,5	2,5	14
16	14	2,8	15
17	14	2,8	16
18	16	3	17
19	16	3	18
20	18	3,5	19
21	18	3,5	20
22	18	3,5	21
23	19	4	22
24	19	4	23
25	20	4,5	24
26	20	4,5	25
27,5	21,2	4,5	26
28,5	21,2	4,5	27
29,5	22,4	5	28
30,5	22,4	5	29
31,5	22,4	5	30

»VELEBIT« TOOL TIPS

for crushers, saws, millers, a. s. o.

DIN 8011

Dimensions in mm



l	S h a p e R				S h a p e T				
	t	s	l ₁	c	t	s	L ₁	c	r
12					3	1,2	4,5	1	15
16	2,5	1,2	7,1	1	3,5	1,6	7,5	1	15
19	3	1,4	9	1	4,5	2	7,5	1,8	25
22	3,5	2	11,2	1,4	5,6	2,5	9,5	2,5	25
25	4	2,2	15	1,4	8	2,8	10	3	25
30	5	2,8	18	1,4					

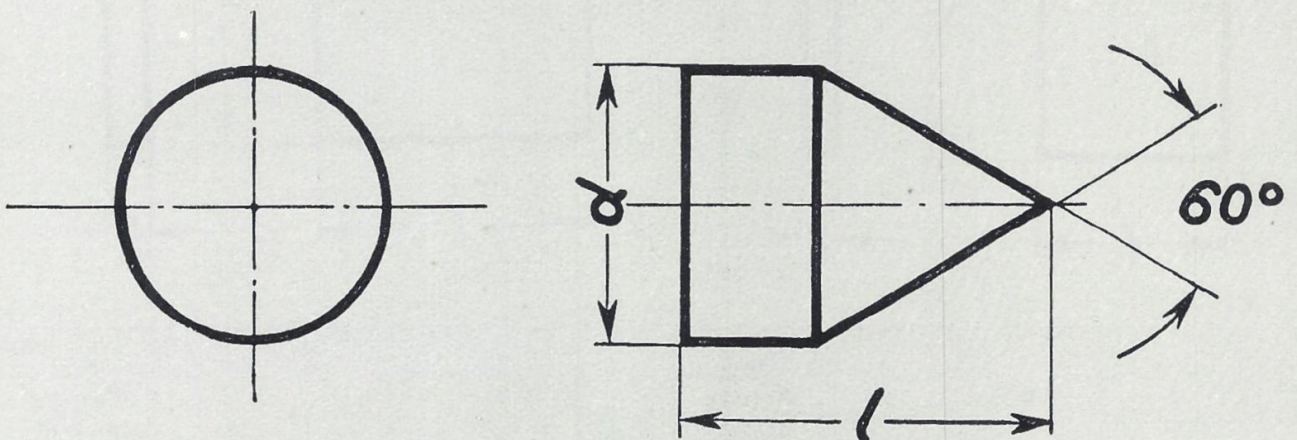
l	S h a p e U					S h a p e V				
	t	s	l ₁	c	r	t	s	a	l ₁	c
12	5,6	1,2	1,4	1	15					
16	6,7	1,6	4	1	15					
19	8	2	2,5	1,8	25					
22	11,2	2,5	2,8	2,5	25	5,6	2,5	3	9	2,5
25	14	2,8	4	3	25	8	3	5	10	2,8
30						12	4	8	11	3,0

»VELEBIT« INSERTION PIECES

for lathe centers

DIN 8012

Dimensions in mm



Diameter d	l	For Morse cone	For metr. cone
5	12	0	9
7	14	1 and 2	12 and 18
11	20	3	24
14	22	4	32
18	30	5 and 6	40, 50 and 60

»VELEBIT« TOOL TIPS

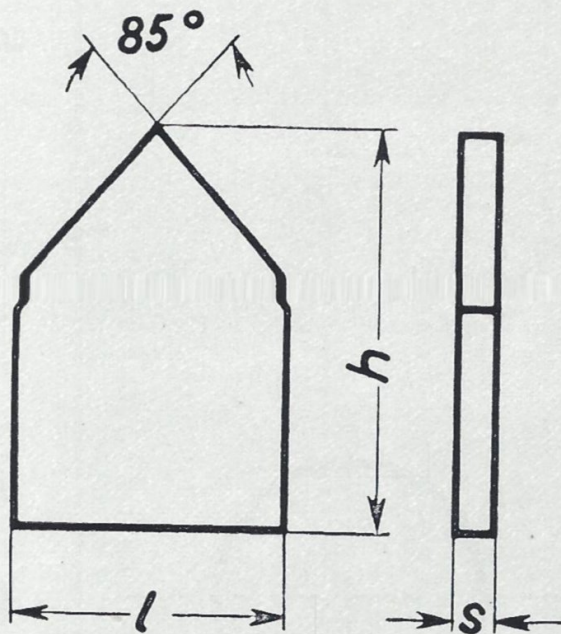
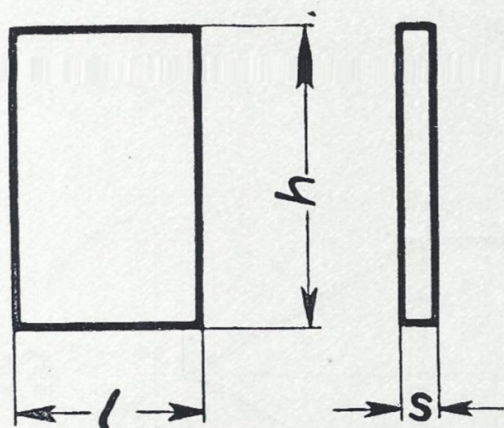
for drills

DIN 8013

Dimensions in mm

l = 4,5 to 31 mm

l = 2 to 4 mm



l	h	s	For diameter of drill
2	4	0,3	1,5
2,5	4,5	0,3	2
3	5	0,4	2,5
3,5	5,5	0,5	3
4	6	0,6	3,5
4,5	7	0,6	4
5	7	0,8	4,5
5,5	8	0,8	5
6	8	0,8	5,5
6,5	9	1,0	6
7	9	1,0	6,5
7,5	9	1,0	7
8	10	1,2	7,5
8,5	10	1,2	8
9	10	1,2	8,5
9,5	11,5	1,4	9
10	11,5	1,4	9,5
10,5	11,5	1,4	10
11,3	12,5	1,6	10
11,8	12,5	1,6	11

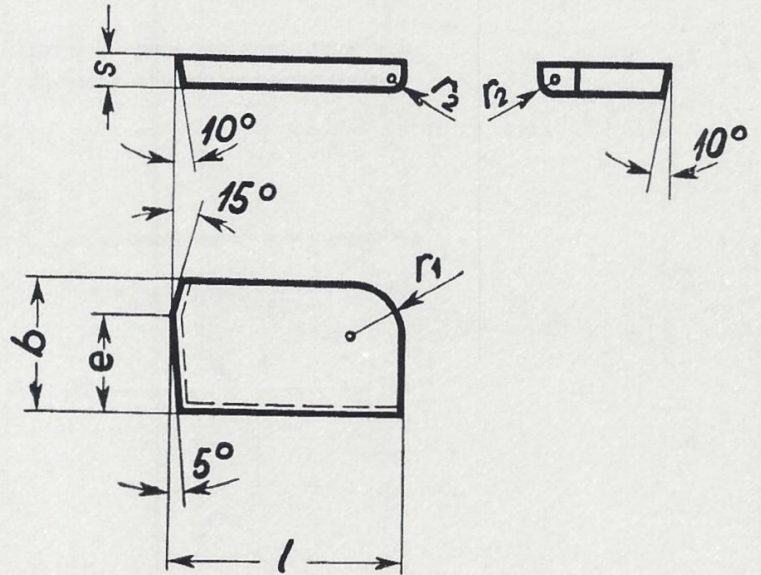
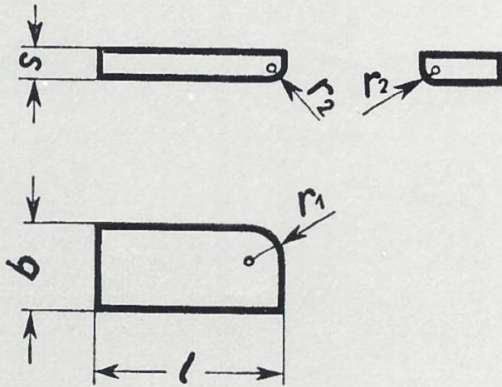
l	h	s	For diameter of drill
12,3	12,5	1,9	11,5
12,8	14	1,9	12
13,8	14	1,9	13
14,8	14	2,2	14
15,8	17	2,2	15
16,8	17	2,2	16
17,8	20	2,2	17
18,8	20	2,2	18
19,8	23	2,5	19
20,8	23	2,5	20
22	23	2,5	21
23	26	2,5	22
24	26	2,8	23
25	26	2,8	24
26	26	3	25
27	26	3	26
28	29	3	27
29	29	3,5	28
30	29	3,5	29
31	29	3,5	30

»VELEBIT« TOOL TIPS
for drills with single cutting edge
DIN 92165

b = 4 to 9 mm

Dimensions in mm

b = 10 to 42 mm



b	e	l	r ₁	r ₂ ≈	s	Corresponding guide
4		14	2,5	0,6	1,2	1,2 G 1 DIN 92166
5		14	2,5	0,6	1,2	
6		16	2,5	1	1,6	1,6 G 1 DIN 92166
7		18	2,5	1	2	2 G 1 DIN 92166
8		18	4	1	2,5	
9		20	4	1	2,5	2,5 G 1 DIN 92166
10	7,2	20	4	1,6	3	
11	8	22	4	1,6	3	3 G 1 DIN 92166
12	9	22	6	1,6	3	
14	10,5	25	6	1,6	3,5	4 G 1 DIN 92166
16	12	25	6	1,6	3,5	

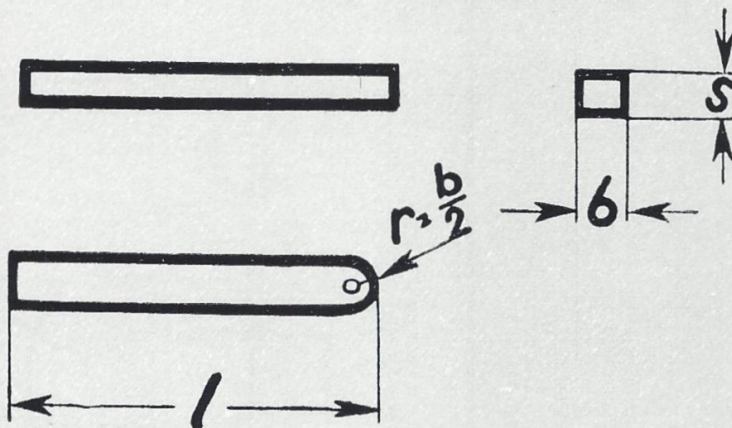
Depth P	e	l	r ₁	r ₂ ≈	s	Corresponding guide
18	13,5	28	6	1,6	4	5 G 1 DIN 92166
20	15	28	6		4	
22	16,5	32	6		4,5	6 G 1 DIN 92166
24	18	32	6		4,5	
26	20	32	6		5	
28	22	36	6		5	8 G 1 DIN 92166
30	24	36	6		6	
32	26	40	10		6	
35	28	40	10		7	
38	30	40	10		7	
42	32	45	10	8		

»VELEBIT« GUIDES

for drills

Dimensions in mm

DIN 92166



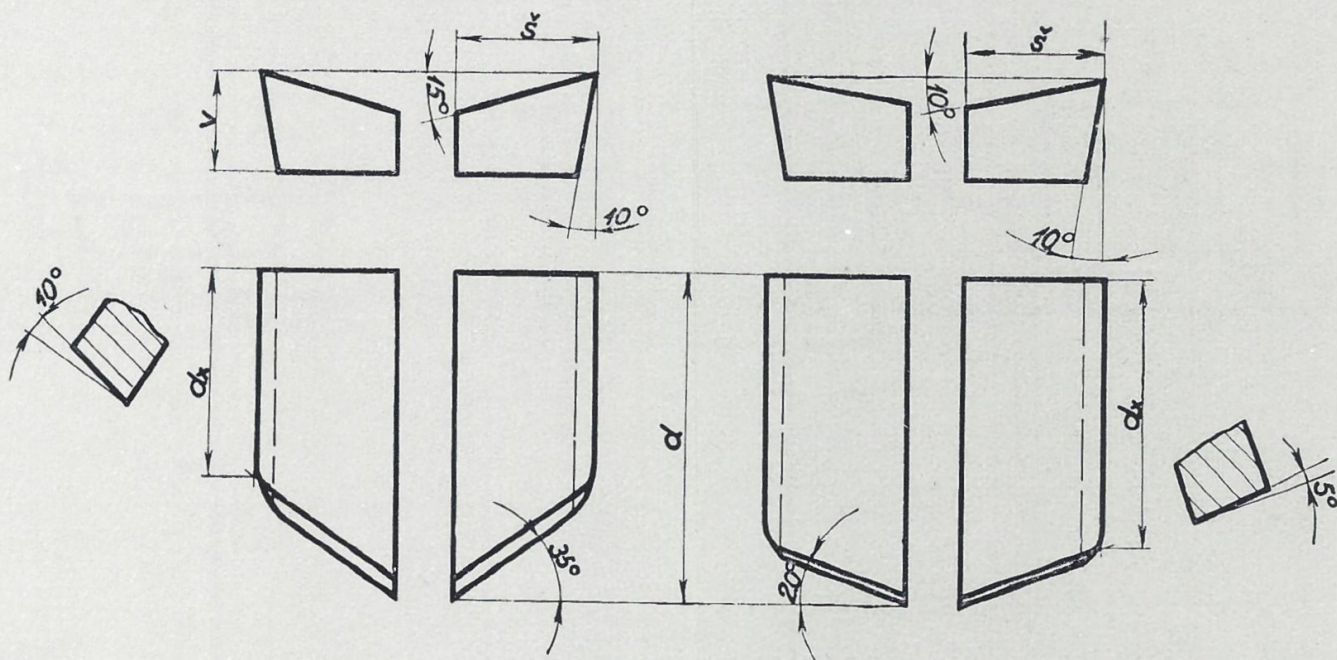
b	l	s
1,2	18	1,2
1,6	20	1,6
2	22	2
2,5	25	2,5
3	28	3
4	32	3
5	36	4
6	40	5
8	45	5
10	50	5

NOTE: Guides to inclusively $b = 3$ mm are made without rounding $r = \frac{b}{2}$

»VELEBIT« TOOL TIPS

for machining on the planer

Dimensions in mm



L — Left-hand tool

L — Left-hand tool
D — Right-hand tool

D — Right-hand tool

Symbol		d_x	ξ	v	d
Left-hand	Right-hand				
12 L	12 D	12	10	8	19
16 L	16 D	16	12	9	24
20 L	20 D	20	14	10	30
25 L	25 D	25	16	12	36
32 L	32 D	32	20	14	46
40 L	40 D	40	25	18	57

For machining cast iron G 1

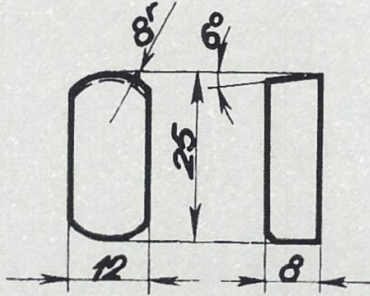
Symbol		d_x	ξ	v	d
Left-hand	Right-hand				
16 L	16 D	16	10	8	20
20 L	20 D	20	12	9	24
30	10	14	25	25 D	25 L
38	12	16	32	32 D	32 L
40 L	40 D	40	20	14	47
50 L	50 D	50	25	18	59

For machining steel S 3 or S 4

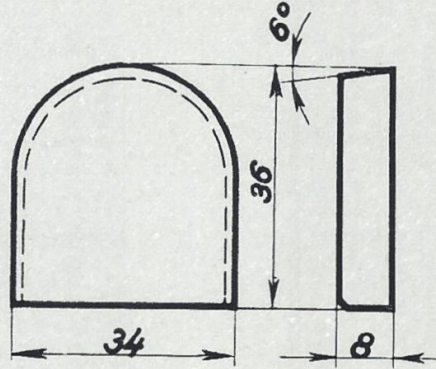
»VELEBIT« TOOL TIPS

Tips for machining bandages

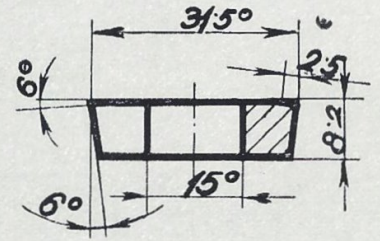
Dimensions in mm



Shape I



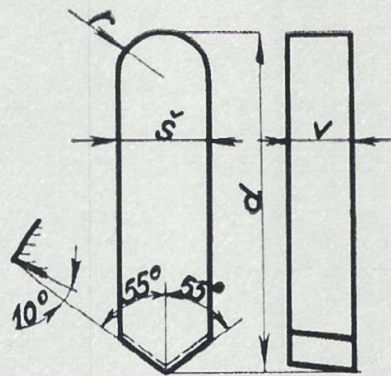
Shape II



Shape III

TOOL TIPS FOR GROOVING

Dimensions in mm

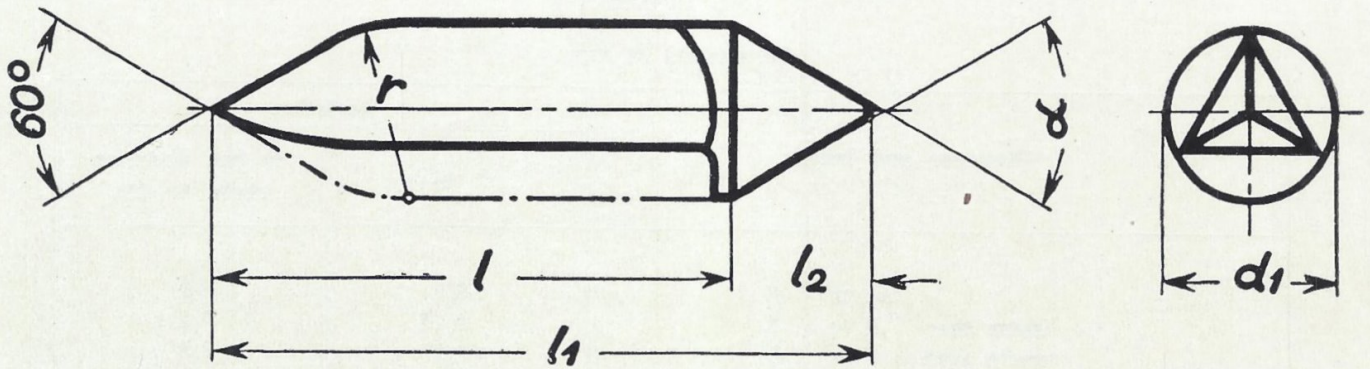


Shape	d	š	v	r
I	30	6	5	3
II	30	8	6	4

For machining mill rollers and similar hard material use grade H 1

»VELEBIT« INSERTION PIECES for glass drills

Dimensions in mm

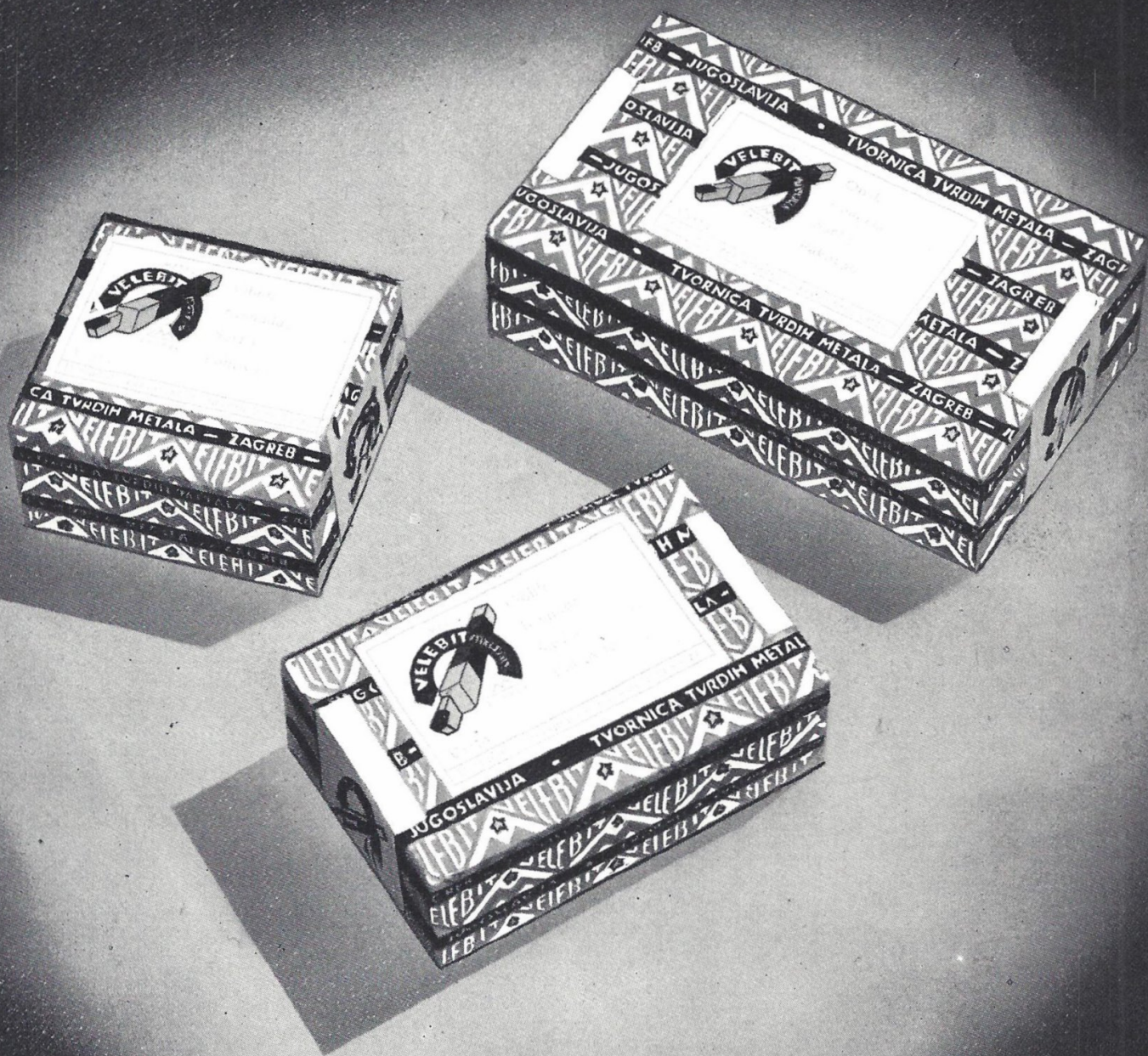


For drills diameter	d_1 mm	l mm	l_2 mm	l_1 mm	r mm	α
3	3,5	24	6	30	5	30°
3,5	4	24	6	30	5	30°
4	4,5	24	6	30	5	35°
4,5	5	25	6	31	5	35°
5	5,5	25	6	31	5	35°
5,5	6	25	7	32	8	40°
6	6,5	25	7	32	8	40°
6,5	7	27	7	34	8	40°
7	7,5	27	7	34	8	45°
7,5	8	29	7	36	8	45°
8	8,5	29	8	37	12,5	50°
8,5	9	29	8	37	12,5	50°
9	9,5	29	8	37	12,5	55°
9,5	10	31	8	39	12,5	55°
10	10,5	31	8	39	12,5	60°
10	11,5	31	8	39	12,5	60°
12	12,5	34	9	43	16	65°
13	13,5	34	9	43	16	65°
14	14,5	35	9	44	16	70°
15	15,5	35	9	44	16	70°
16	16,5	36	10	46	20	75°
17	17,5	36	10	46	20	75°
18	18,5	37	10	47	20	80°
19	19,5	37	10	47	20	80°
20	20,5	37	10	47	20	80°

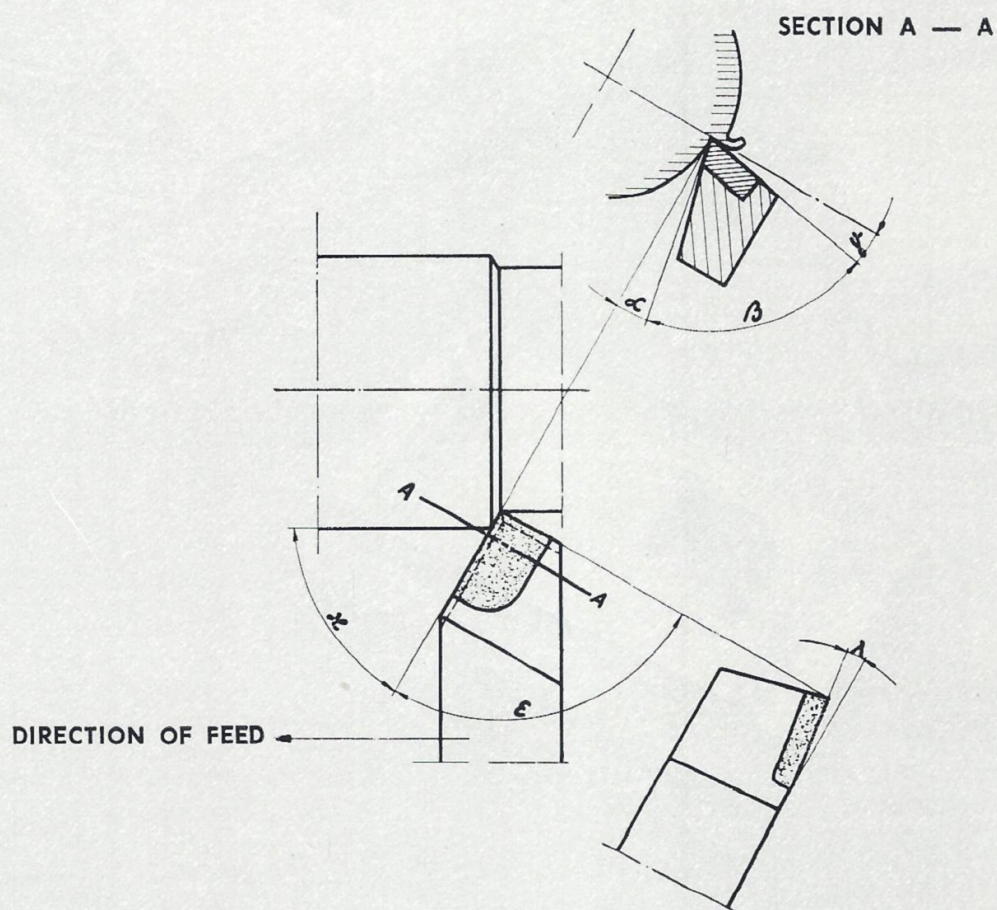
VELEBIT TOOL TIPS OF ALL SHAPES
 ARE NORMALLY DELIVERED IN ACCORDANCE WITH DEVIATIONS QUOTED
 AS UNDER

Dimensions in mm

Diameter and length	Deviation	
	+ or—	In one direction more or less
up to 2 more than 2 to 4 more than 4 to 6	0,1 0,15 0,2	0,2 0,3 0,4
more than 6 to 8 more than 8 to 10 more than 10 to 13	0,25 0,3 0,35	0,5 0,6 0,7
more than 13 to 16 more than 16 to 20 more than 20 to 25	0,4 0,45 0,5	0,8 0,9 1
more than 25 to 30 more than 30 to 35 more than 35 to 40	0,55 0,6 0,65	1,1 1,2 1,3
more than 40 to 45 more than 45 to 50 more than 50 to 55	0,7 0,8 0,9	1,4 1,6 1,8
more than 55 to 60 more than 60 to 70 more than 70 to 80	1 1,2 1,4	2 2,4 2,8
more than 80 to 90 more than 90 to 100 more than 100 to 110	1,6 1,8 2	3,2 3,6 4
more than 110 to 125 more than 125 to 140 more than 140 to 155	2,2 2,5 2,8	4,4 5 5,6
more than 155 to 170 more than 170 to 185 more than 185 to 200	3 3,4 3,8	6 6,8 7,6



THE ANGLES OF THE CUTTING EDGE OF CUTTING TOOLS



THE ANGLES OF THE CUTTING EDGE

α — clearance angle

β — cutting angle

γ — true rake angle

ζ — plan angle

ϵ — nose angle

γ — angle of inclination

THE TRUE RAKE ANGLE γ

The most prominent of all angles of cutting tools and other tools for machining by means of metal cutting is the true rake angle γ (vide Fig. 2). It is of the correct choice of this angle that depends the life of the cutting tool and the correct entering of the cutting edge into the material, the required power for machining simultaneously being connected with it.

With regard to the strength of the cutting tool, one selects a bigger angle γ and lower cutting speeds for a tougher hard metal and vice versa. So for instance, if machining with low cutting speeds was not satisfactory with a tool which was brittle and had a small angle γ , machining can be improved either by increasing the cutting speed or by exchanging the tool for an other one with a tougher cutting point of hard metal. In such a case the tool tip may have a bigger angle γ . The angle γ varies also according to the material to be machined. It is smaller for material of a short-chipping nature (cast iron); for steel and cast steel, i. e. for material of a long-chipping nature one selects a greater angle. Moreover, for particularly hard material a negative angle γ is ground on the already existing positive angle (vide Fig. 2). The value of the negative angle γ_2 is 10° to 15° . Thus higher cutting speeds are made possible, and the life of the tool tip is prolonged.

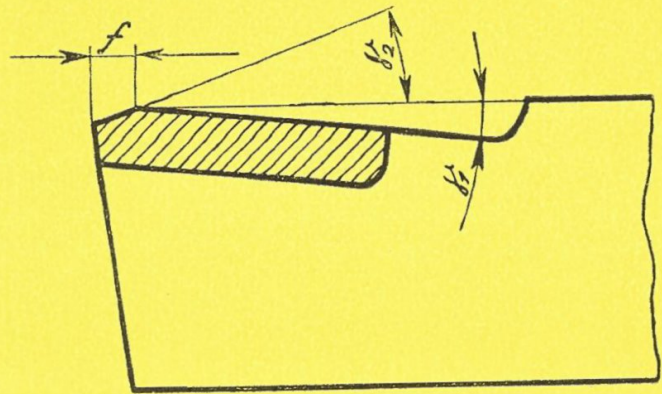


Fig. 2

THE CLEARANCE ANGLE α

For this angle, the value of which varies between 2° and 12° , it is necessary to find some mean value. Small values of α favourably influence cutting operation but are unfavourable as far as the friction arising between tool and workpieces is concerned.

In order to strengthen the cutting point it is advisable, in the same way as it was recommended in the case of the true rake angle, to grind an angle 2° smaller than angle γ (vide Fig. 3).

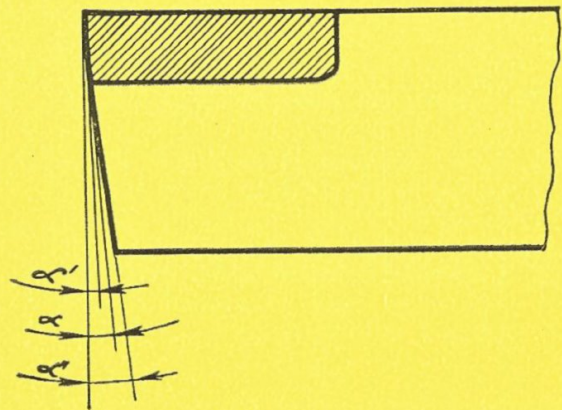


Fig. 3

THE PLAN ANGLE κ

The influence of the plan angle manifests itself at the cutting speed and the resistance to cutting. The value of this angle varies normally between 30° and 60° . If the plan angle κ is great the active length of cutting is smaller and thus the specific stress on the tool greater and the life of the tool reduced. If the plan angle is very small vibration of the tool may occur and that should be avoided by all means.

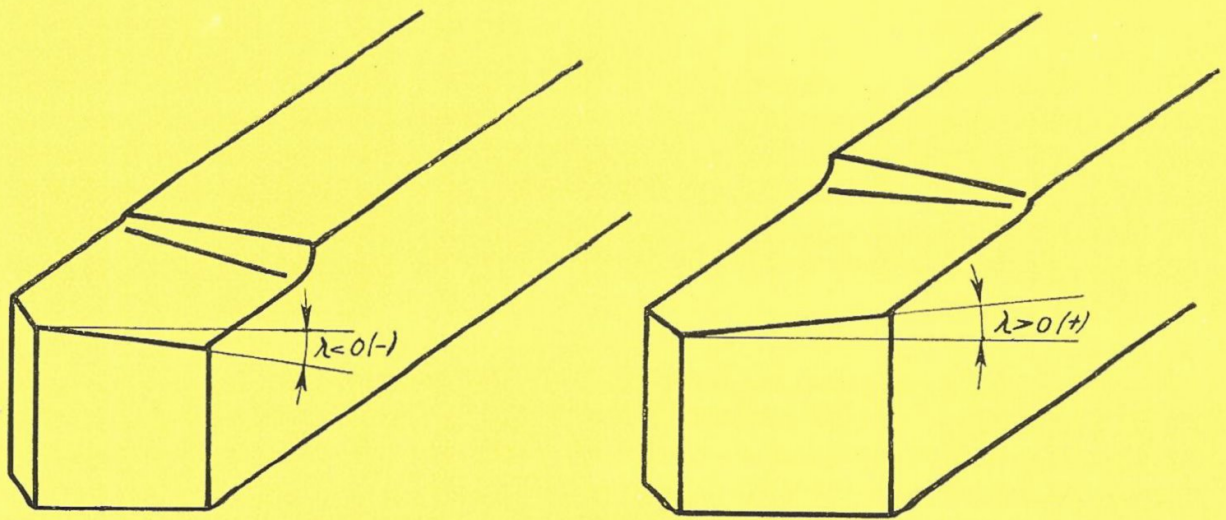


Fig. 4

THE ANGLE OF INCLINATION λ

In case of lathe tooling with a hard metal the angle of inclination is of very great importance (Fig. 4). By proper selection of this angle the most delicate part of the tool, its nose, is protected. Hence for interrupted cuts and such of varying depth of cutting positive angles λ are chosen the value of which varies from 5° to 8° . In case of planing steel and cast iron the angle λ to be used is 10° .

THE NOSE RADIUS »r« AND THE CHIP BREAKER

Apart from all geometrical dimensions in order to increase the strength of the cutting edge of the tool its nose is rounded off with the radius »r«. Its dimensions amount for finish cutting to 1 to 2 feeds in mm whereas for rough cutting »r« is equal to 2 to 4 feeds.

In order to facilitate the sliding-off of the chip when machining material of a long-chipping nature a special offset is provided for on the tool (vide Fig. 5). Its duty is to roll up the chip and break it, thus increasing order and safety of operation. The dimensions and shape of the offset depend on the feed and the machined material. Standard dimensions are quoted in a table. Usually a broad offset is given for great feeds, and a narrow one for small feeds.

For making the step use:

1. A SiC grinding wheel 120 K, dimensions 150×8 with 10 m per sec or.
2. a diamond grinding wheel D 100 with metal bond, dimensions 100×5 with 15 m per sec.

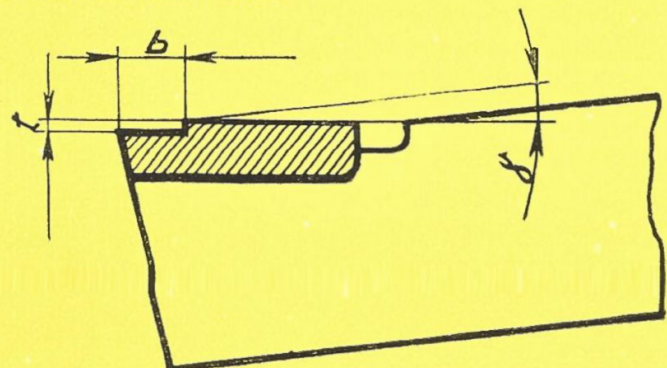


Fig. 5

Table showing dimensions of chip breaker

MATERIAL	DEPTH t	WIDTH b
Steel 50 — 70 kg per sq.mm	1,0 mm	6 times the feed
Steel 80 — 110 kg per sq.mm	0,8 mm	5 times the feed
Steel 110 — 140 kg per sq.mm	0,6 mm	4 times the feed

TABLE SHOWING ANGLES FOR VARIOUS KINDS OF MATERIAL

(vide Fig. 1)

M A T E R I A L	Clearance angle	True rake angle
Steel up to 70 kg/mm ²	6°	10° to 15°
Steel with 70 to 100 kg/mm ²	6°	7° to 12°
Steel with 100 to 150 kg/mm ²	6°	4° to 8°
Hardened steel more than 150 kg/mm ²	5°	—5° to +4°
Cast steel up to 50 kg/mm ²	6°	6° to 10°
Cast steel more than 50 kg/mm ²	6°	2° to 8°
Hard manganese steel	6°	2° to 10°
Grey casting up to 200 Brinell	6°	8° to 10°
Grey casting more than 200 Brinell	6°	6°
Hard gravity die casting up to 75 Shore	4°	0°
Alloyed hard gravity die casting more than 75 Shore	4°	—4° to 0°
Malleable cast iron	6°	4° to 8°
Copper	8°	15° to 22°
Brass	6°	10° to 12°
Bronze	6°	10°
Light metal alloys up to 50 Brinell	8° to 10°	15° to 25°
Light metal alloys 50—100 Brinell	8°	8° to 0°
Light metal alloys 100—150 Brinell	6°	6° to 10°
Light metal alloys with high content of silicon more than 130 Brinell	6°	6° to 10°
Ebonite, synthetic and pressed material	8° to 12°	10° to 17°
Rock of medium hardness (for inst. marble)	5°	0° to 5°
Rock of high hardness (for inst. granite)	5°	—6°
Glass	5°	—6°

TABLE SHOWING BASIC VALUES OF CUTTING SPEEDS WITH »VELEBIT« HARD METAL

M A T E R I A L	C u t t i n g s p e e d s m/min.			
	S1	S2	S3	S4
	roughing — finishing	roughing — finishing	roughing — finishing	roughing — finishing
Steel up to 60 kg/mm ²	85 — 160 — 270	70 — 130 — 200	50 — 90 — 160	30 — 55 — 115
Steel 60—85 "	65 — 110 — 220	45 — 90 — 165	45 — 70 — 120	25 — 50 — 95
Steel 85—110 "	60 — 100 — 180	40 — 70 — 110	25 — 60 — 100	20 — 35 — 75
Alloyed and super-refined steel 110—140 "	25 — 70 — 100	25 — 50 — 75	20 — 40 — 50	15 — 25 — 45
Cast steel up to 50 "	65 — 100 — 165	50 — 90 — 120	40 — 70 — 95	30 — 50 — 70
Cast steel more than 50 "	40 — 70 — 125	25 — 60 — 100	20 — 40 — 80	15 — 30 — 60
Non-rusting Cr-Ni steel (austenite)	30 — 50 — 70	25 — 40 — 60	Possible usability of U1, U2, H1 or H2	
Hard manganese steel	The use of U1 is recommended, and for planing U2.			
Hardened steel of more than 180 kg/mm ²	Cutting speeds from 10 to 30 m/min.			
	Possible usability U1 (G1, H1, and H2) with 5—30 m/min.			

TABLE SHOWING BASIC VALUES OF CUTTING SPEEDS WITH »VELEBIT« HARD METAL

M A T E R I A L	Hardness	»Velebit« Type	Cutting speeds m/min roughing — finishing
Grey cast iron	up to 200 Br. 200 — 250 Br. 250 — 400 Br.	G1 (U1, U2)	40 — 80 — 120
Grey cast iron		U1 (H1, U2)	20 — 60 — 100
Grey cast iron		H1 (H2, U1)	15 — 25 — 45
Malleable cast iron of grey cast iron structure	up to 75 Shora more than 75 Shora	G1 (U1, H1)	20 — 55 — 90
Malleable cast iron of cast steel structure		U2	30 — 75 — 100
Chill casting	up to 75 Shora more than 75 Shora	H1 (H2)	7 — 11
Alloyed chill casting		H2	3 — 7
Copper	up to 50 Br. 50 — 100 Br. 100 — 130 Br.	G1	120 — 200 — 290
Brass and bronze		G1 (U1, H1)	120 — 240 — 340
Alloyed light metals	more than 120 Br.	G1	400 — 1000 — 1500
Alloyed light metals		G1 (U1, H1)	200 — 500 — 800
Alloyed light metals		H1 (U1)	100 — 200 — 300
Alloyed light metals with high contents of silicon		H1 (H2, U1)	55 — 100 — 190
Ebonite	more than 120 Br.	H1 (U1, H2)	90 — 250 — 400
Synthetic and pressed material		H1 (H2, G1, U1)	50 — 150 — 300
Rock of medium hardness (such as marble)	more than 120 Br.	G1 (U1, H1)	20 — 40 — 60
Rock of high hardness (such as granite)		H1	4 — 7 — 9

THE MANUFACTURE OF »VELEBIT«-TIPPED TOOLS

For the manufacture of »Velebit«-tipped tools the knowledge of the technological conditions of operation is indispensable. »Velebit« tool tips are made and delivered in standard shapes in accordance with the existing norms of *JUS*, *ISO*, and *DIN*. Hence it will be very seldom necessary that an additional delivery of special shapes will have to be taken into consideration. If, by any chance, some posterior shaping is expedient those operations are carried out by means of special grinding wheels, whereof detailed instructions are given further in the text under the heading »The selection of grinding wheels«.

THE SELECTION OF MATERIAL FOR THE SHANK

Usually the shanks are made of steel with 0,6—0,8 per cent. of C which corresponds to a strength of 70—85 kgs per sqmm. Special shanks which should be of great strength, great heat-resisting quality, and resistance to wear are made of alloyed steels of strength of 110—140 kgs per sqmm. The section of the shank should be as great as possible in order to prevent transfer of vibrations to a certain extent to the hard metal tool tip. The height of the shank under the tool tip should not be less than the triple thickness of the »Velebit« tool tip (Fig. 7).

OPERATION OF MACHINING THE SHANKS

The expert machining of the shanks is of the greatest importance for the life of the hard metal. First of all, the shank is forged to the required shape. A seat for the tool tip is made with the corresponding true rake and inclination angle either on a miller or a lathe. The tool tip must rest with its full surface area on the shank. The seat of the tool tip on the shank must be quite clean, i. e. there must be no organic or anorganic impurities on the seat. The seat is made a trifle longer and wider than the tool tip itself in order to enable the layer of solder to fill in the chamfer between shank and »Velebit« tool tip (Fig. 7).

BRAZING AND SOLDERS

The first step for proper brazing is to grind the tool tip to metallic lustre on the surface which should be brazed. Proper brazing of the »Velebit« tool tip is the most important factor determining the life of hard metal. It is of great importance to select the proper solder for this process. This selection depends on the intended use of the tool. If the tool is very much strained in operation, and if it is exposed to excessive heating it is best to use electrolytic copper as solder. If the tool works under normal conditions a solder with low melting point should be selected, such as bronze or silver. One of the most suitable fluxes is fritted pulverized Borax (80—100 meshes).

The brazing temperatures are for copper 1100° — 1150°C , for bronze 800° — 900°C and for silver 800°C . For bigger tool tips or for tips containing carbide of titanium — and those are all S-grades of hard metal — the use of a gauze of tinned or zinced wire is recommended. This gauze is interposed between the seat on the shank and the tool tip. There are gauzes coated beforehand with some solder. The use of these gauzes reduces the possibility of cracks being formed in the tool tip. Otherwise, such cracks could originate owing to the different coefficient of contraction, the ratio of dilation between steel and »Velebit« hard metal being 2. For the success of brazing it is of great importance to determine the thickness of the gauze. So for instance, for smaller tool tips a thickness of 0,15 mm is recommended, and for bigger ones approximately 0,20 mm. It is particularly important to clean the gauze of all impurities before brazing. If possible, it should be cleaned in a grease extractor, because liquid solvents are not very suitable. Trichloro-ethylene or carbon tetrachloride is usually used for removing these impurities. Particular attention should be paid that the layer of solder is of even height (not too thick) and without cavities. After brazing, care must be taken that, for two or three days, the tool must not be cooled below room temperature. By strictly expert and conscious work only one can achieve a thorough connection between shank and »Velebit« tool tip.

THE APPLIANCES FOR BRAZING »VELEBIT« TOOL TIPS ON THE SHANK

A first-class brazing is performed in special high-frequency or electric an oven in a protective atmosphere best with hydrogen or ammonia gas. Likewise a ovens of special construction can be used, the source of heating being butane and compressed air. (Fig. 6). For shanks of minor section (less than 20×25 mm) electric welders can be used also. Shanks of very small sections can be brazed by oxy-acetylene welding. In case of such brazing particular attention must be paid that the tool tip is not within range of the oxidizing part of the flame. Hence a big burner with reducing flame should be used, and heating should be performed from the shank towards the spot to be brazed. In case of need brazing can be performed in a forge, too, but this is not recommendable. If it is done in this way a small muffle should be made of an iron pipe of refractory brick thus preventing direct action of the flame on the »Velebit« tool tip.

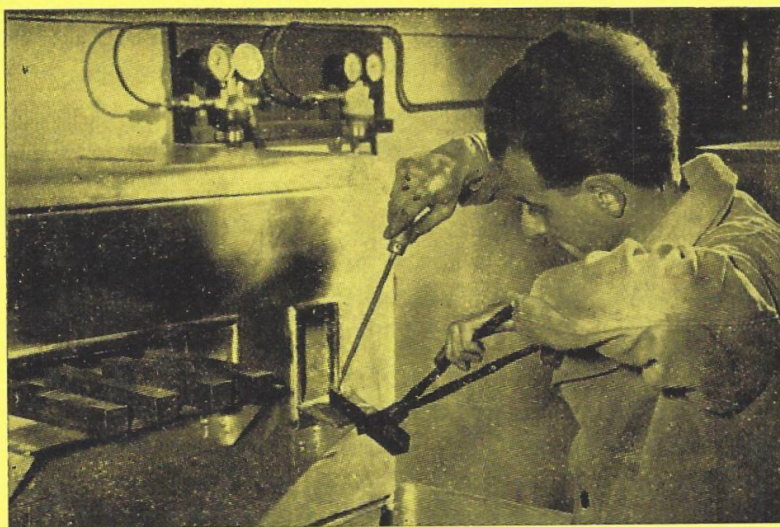


Fig. 6 — The appliances for brazing »Velebit« tool tips on the shank

It was already mentioned that brazing must be done in a reducing atmosphere as the least presence of air causes oxidation respectively decarbonization of the tool tip, and that influences the quality of the hard metal in a very bad way.

THE PREPARATION FOR BRAZING

In the operation of brazing the very process and its preparation represent a decisive factor. The tools' shape and the solder at the disposal themselves determine the process of brazing. Here we shall describe one or two classic methods of brazing.

THE BRAZING PROCESS

The tool tip prepared for brazing is placed on the seat on the shank, and fastened there by an iron wire in order to prevent the tip from moving during the operation of brazing. Then the solder is put on the tip and well sprinkled over with borax. The tool thus prepared is put into the hot oven. When the shank is heated to dark-red heat the tool tip is once more sprinkled over with borax with a little spoon made particularly for this purpose. During brazing the tool tip must be completely covered with borax, thus as far as possible preventing oxidation of the tool tip. The tool is kept in the furnace until the dissolved solder has filled up all chamfers. Then the tool is withdrawn at once from the oven, and the tool tip is gently pressed into the corresponding position on the seat of the shank by means of a pointed bar. The bar is kept on pressing till the solder hardens. The purpose of this pressure is the removal of all superfluous solder between tool tip and the seat on the shank. Too big a layer of solder reduces its strength as binder. The bar must be pointed because too great a contact surface would cause a sudden cooling of the hot »Velebit« tool tip, and that on the spot of contact only, which might lead to the formation of cracks. During this exertion of pressure the »Velebit« tool tip should be thermically isolated at its base. Further, the tool should be cleaned with a steel brush from slag and other impurities. After brazing, tools must be slowly cooled in dry ash, pulverized charcoal, or in graphite powder. As can be seen from the above cooling must gradually take place in order to prevent formation of cracks as the result of thermic straining. Hence cooling in water or any similar medium must be taken to be fundamentally wrong. When the tool is cooled in accordance with the given instructions it will be ground. For the brazing of tools of major size gauzes are used in that fashion that the gauze is interposed between the tool tip and its seat. Copper solder is put on the tool tip and, after melting, it fills the chamfers between tool tip and shank. For greater »Velebit« tool tips copper foils are placed on the gauze and under it. If gauzes coated beforehand with solder (triplex solder) are used the interposition of copper foils is to be OMITTED (Fig. 8).

GENERAL REMARKS ON GRINDING

Not only the tool's life but the aspect of the machined workpieces also, and the quantity of workpieces depend on the grinding of the »Velebit« cutting edge and the correct selection of the tools angles. Hence we recommend to do all tool grinding in a central tool grinding workshop, and have the grinding done by a trained staff.

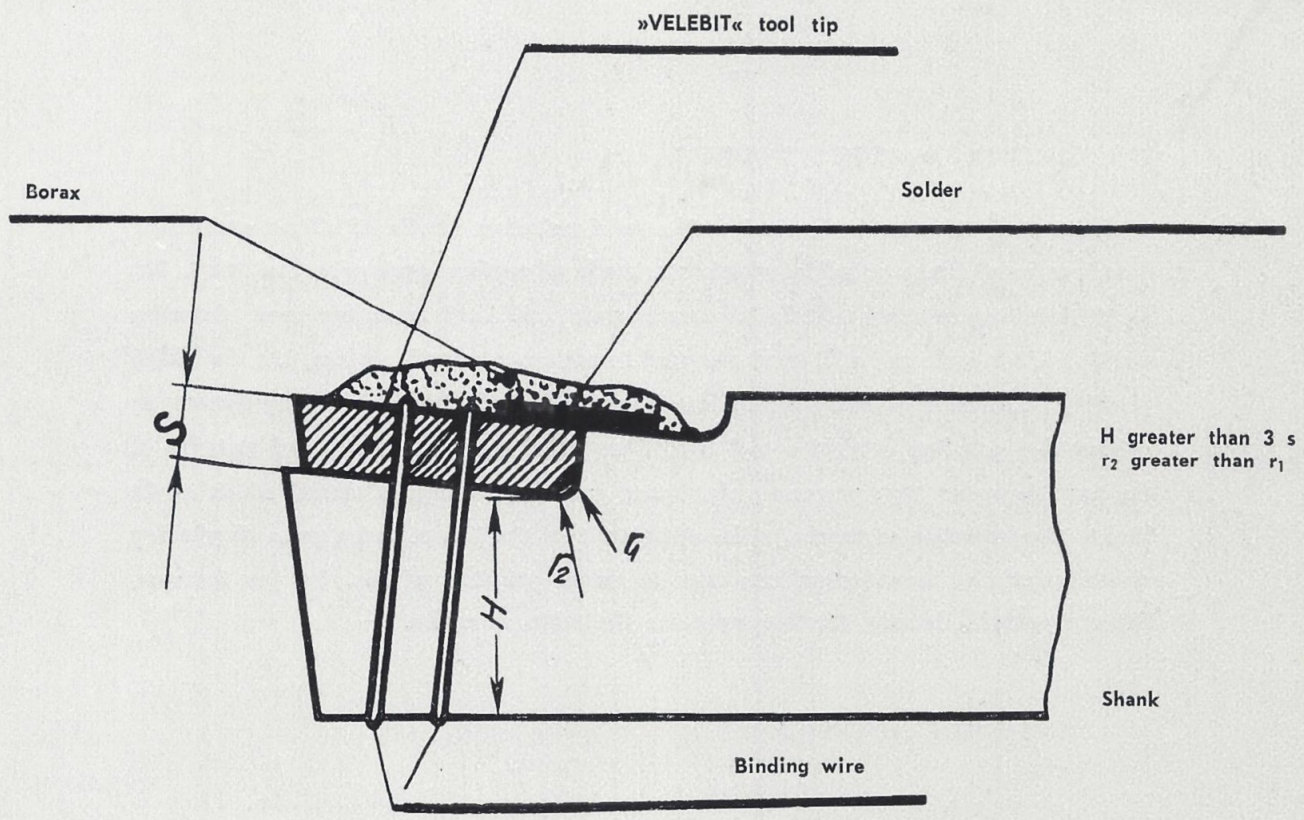


Fig. 7

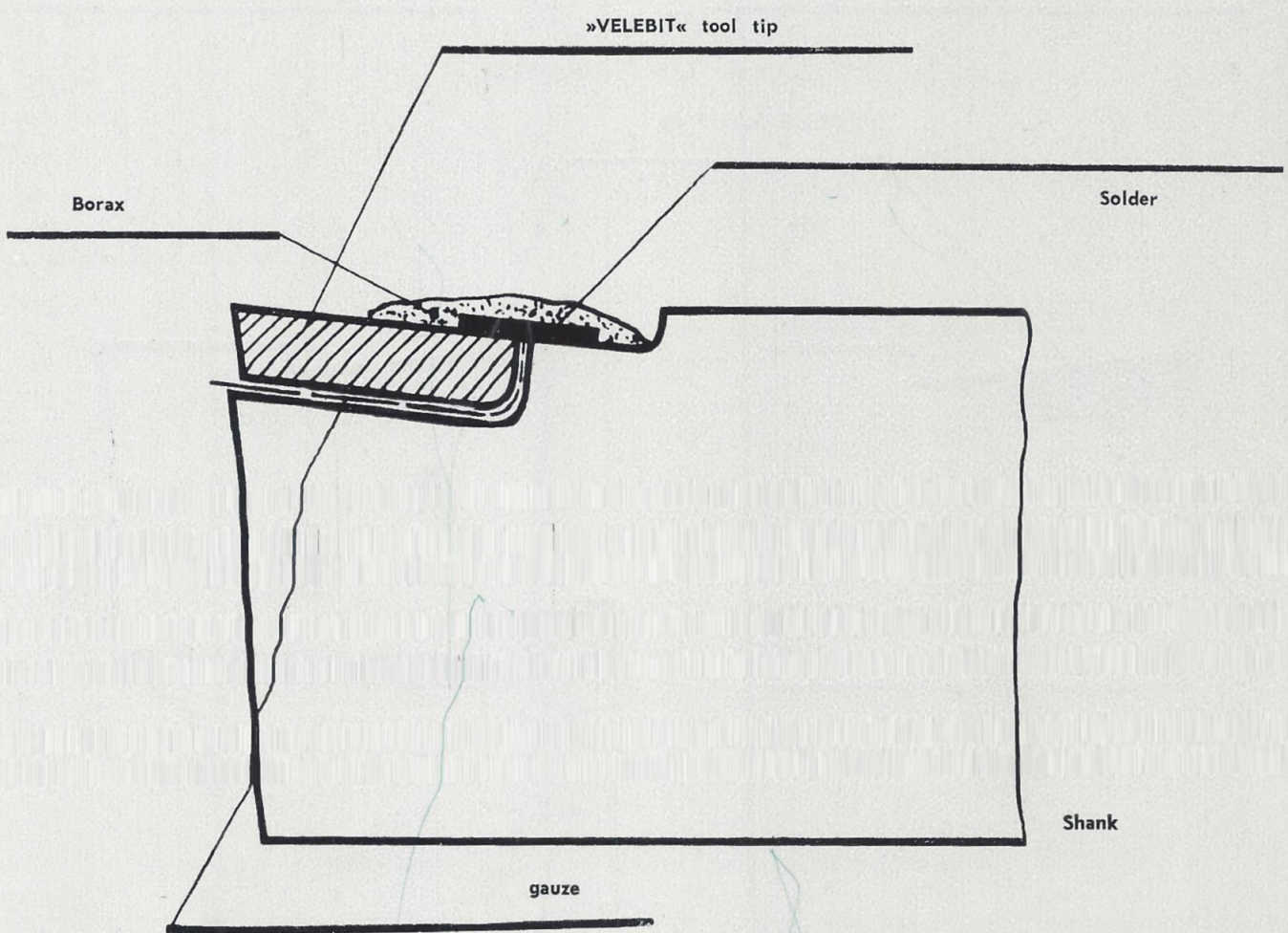


Fig. 8

THE CORRECT WAY OF BRAZING THE TOOL TIP ON TO THE SHANK

THE SELECTION OF GRINDING WHEELS

»Velebit« tool tips can be ground with special grinding wheels of silicon carbide or diamonds only. These grinding wheels are made of various grain size and bond. For rough grinding grinding wheels of coarse grain and hard bond are used. Grinding wheels of fine grain and soft bond are used to achieve a smooth surface, i. e. for finish grinding. Corundum grinding wheels can be used for grinding shanks only but on no account for grinding »Velebit« tool tips. They grind away the very hard material of the tool tip under high pressure only. Hence excessive heating is caused which might lead to the formation of cracks in the »Velebit« tool tip. The manufacturers of grinding wheels regularly issue instructions how to select grinding wheels. So, for instance, Tovarna umetnih brusov, Maribor proposes the table as under.

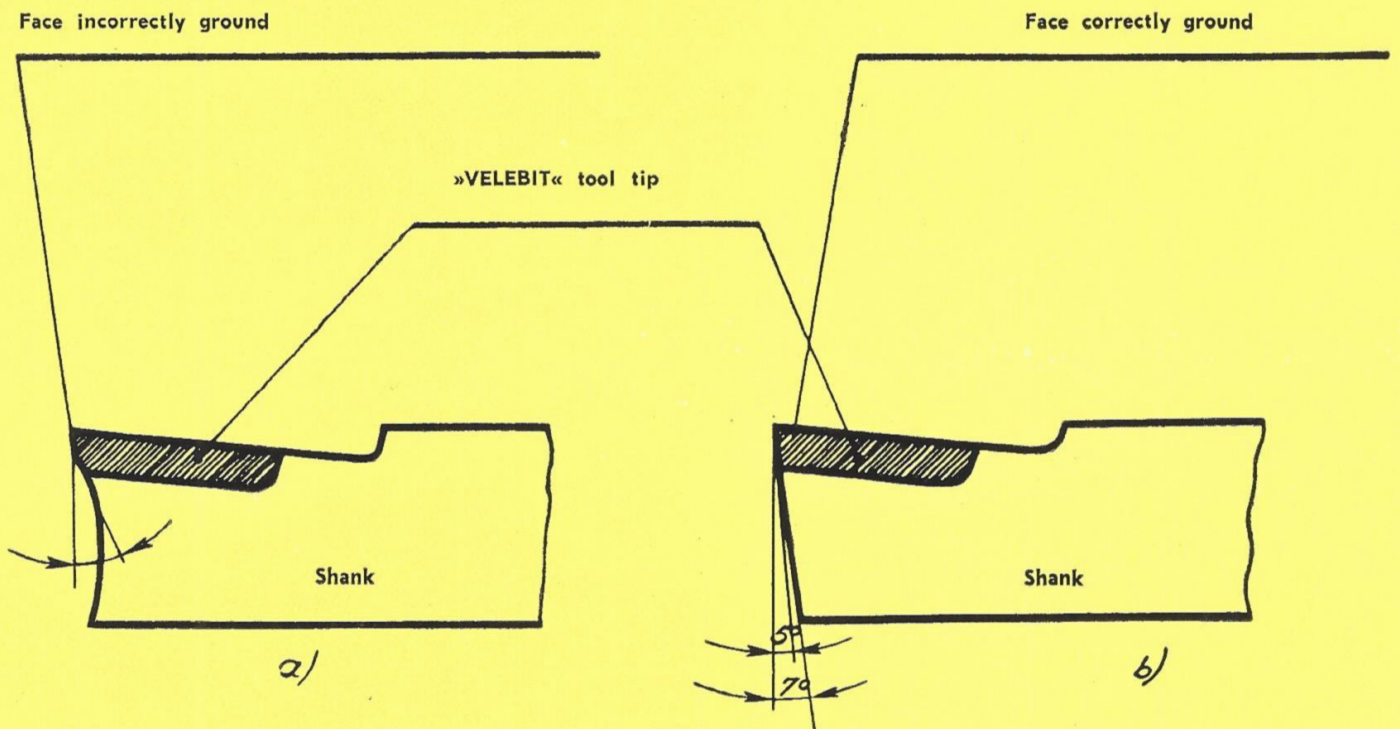


Fig. 9

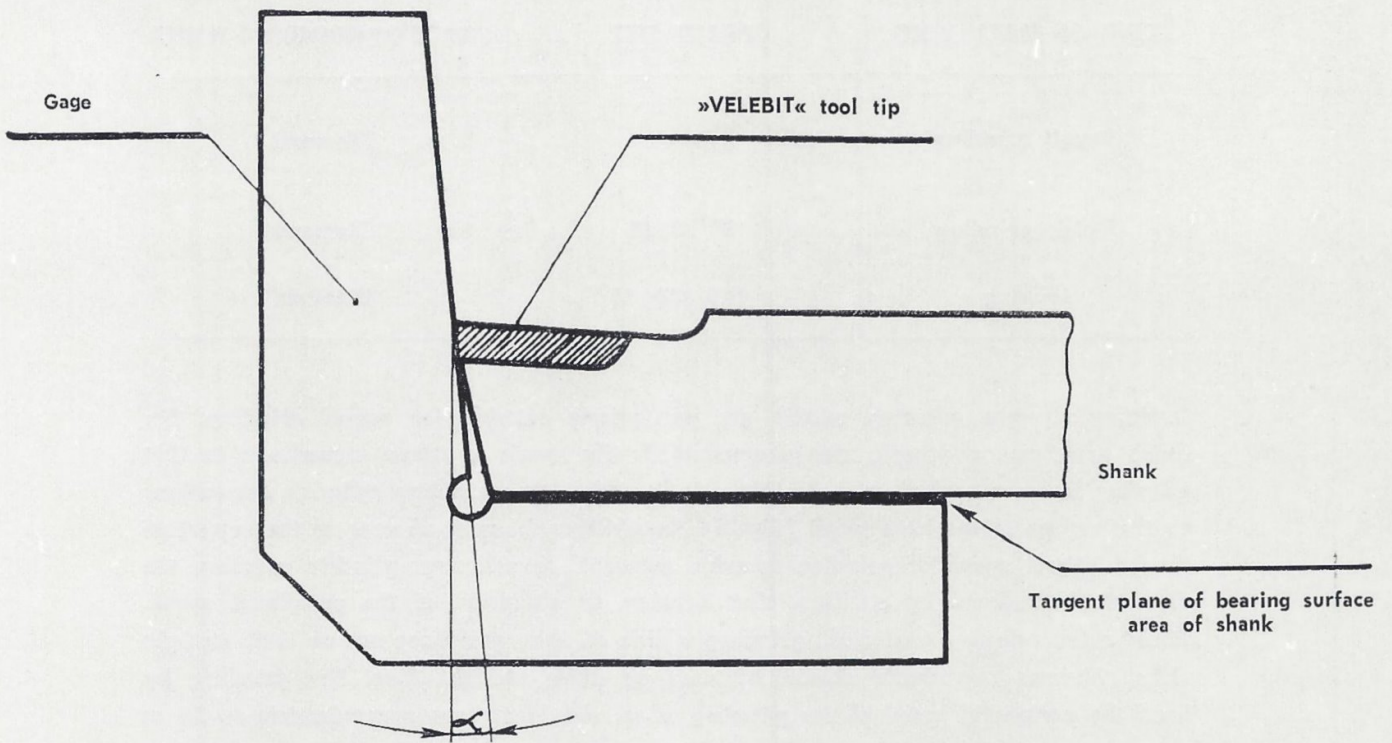
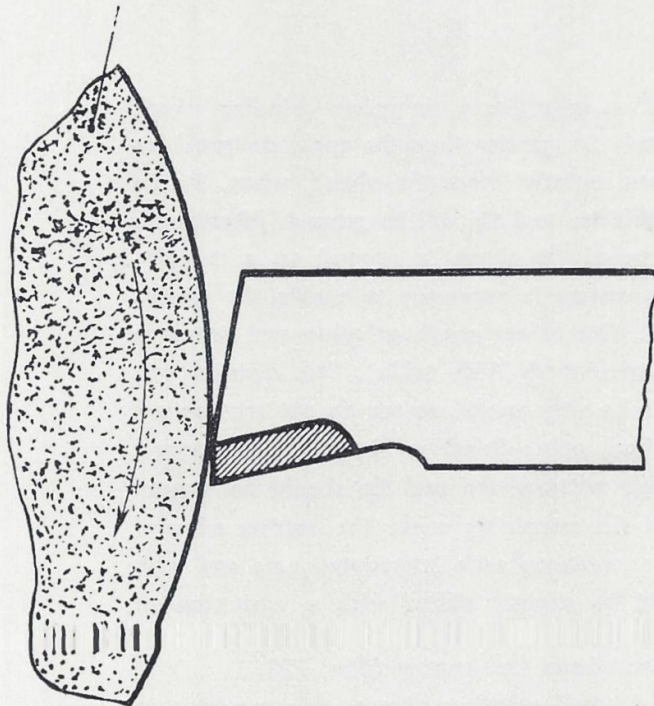


Fig. 10

Incorrect grinding in the direction of the cutting edge



Correct grinding against the cutting edge whilst simultaneously raising and lowering it at the face of the grinding wheel

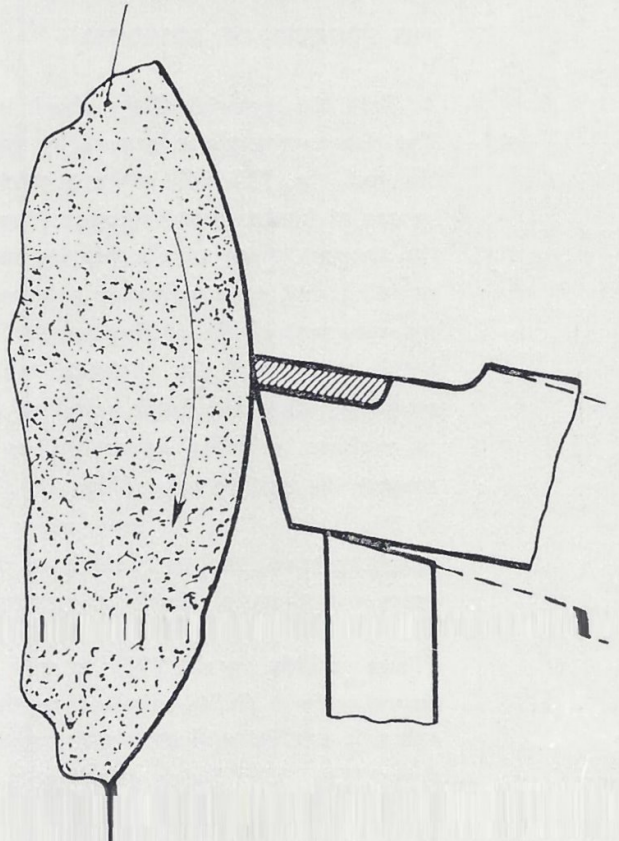


Fig. 11

KIND OF MACHINING	GRAIN SIZE	GRADE OF GRINDING WHEEL
Rough grinding	46 JK	Diamond
Finish grinding	80/90 JK	Diamond
Lapping	280/320 IJ	Diamond

Ordinary straight grinding wheels are particularly suitable for rough grinding. For finish grinding cup-wheels are recommended. The merit of these cup-wheels is that grinding is accomplished on a straight grinding face, thus avoiding cylindrical excavations on the surface of the hard metal (Fig. 9). In addition, in spite of wear of the cup-wheel the peripheral speed of grinding remains constant. In ordinary cylindrical grinding the diameter is reduced by attrition, thus causing an alteration of the peripheral speed. Observe the rule to use straight grinding wheels on their periphery not on their straight sides, whereas cup-wheels should be used on their straight face. For grinding by hand the peripheral speed of the grinding wheel should amount approximately to 25 m per sec, and for automatic grinding 5—10 m per sec. If the wheel loses its perfect circular shape or is getting dull it is honed with a diamond. The grinding machines must be rigidly designed, and the grinding wheel must run quiet and perfectly true. Movable clamping devices on the grinding machine facilitate the correct grinding of all angles of the cutting tool.

THE PROCESS OF GRINDING

At first, the material of the shank is ground on an ordinary corundum grinding wheel. The clearance angle is ground by approximately 2° greater than the angle designed for the tool tip. This will prevent grinding away material from the shank, when, in the course of further grinding operations, the «Velet» tool tip will be ground. Afterwards, the tangent plane of the bearing-surface area of the shank is ground on a straight-grinding unit or a miller or a lathe. This operation is necessary to enable the precise measurement of the cutting angles (Fig. 10). Not before rough grinding and hereafter finish grinding of the «Velet» tool tip is performed (Vide table). This division into rough grinding and finish grinding proved to be very useful, so we do not recommend to perform grinding operations on one wheel only. Grinding should be performed against the cutting edge (Fig. 11). The single parts of the tool tip should be ground in this order: first the face, and afterwards the remaining ones. The cutting edge of roughing tools, and particularly of tools for operations with interrupted cuts and with great variations of depth of cutting, should be slightly dulled with a whetstone of silicon carbide (grain 200) or with a diamond hone for lapping (Fig. 12).

Never perform finish grinding on the face of small grinding wheels, this resulting in cylindrical cavities and incorrect angles. To prevent this slowly move the tool tip up and down (Fig. 11). Finish grinding is best accomplished on a cup-wheel. For automatic

grinding grinding wheels are used the bond of which is by 1 or 2 degrees softer than usual. The speed is considerably lower (5—10 m per sec). The cutting angles should be ground to be in accordance with the material they are intended for. During the grinding operation the cutting angles must be checked by means of corresponding gages (Fig. 10). Whilst being ground the tool should be moderately pressed against the grinding wheel. The grinding capacity must not be increased by higher pressure but by using a coarser-grain grinding wheel. Too high a grinding pressure causes local heating of the tool tip and thus the formation of cracks. The finer the grain of the grinding wheel the lower should be the grinding pressure.

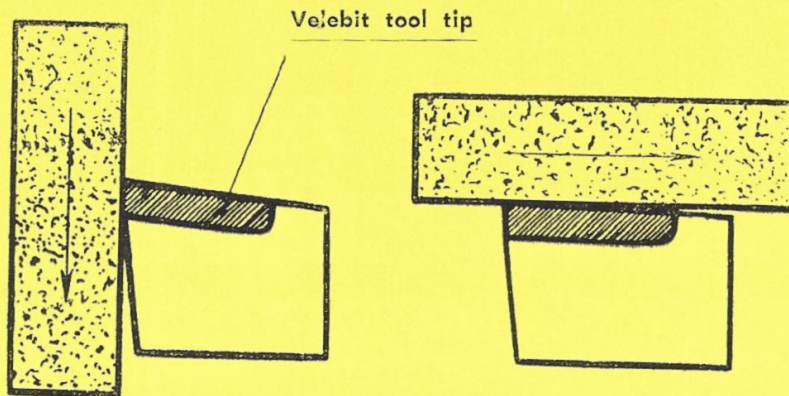
WET OR DRY GRINDING

Grinding can be performed wet or dry. We recommend wet grinding. The flow of water should be abundant and even, and under low pressure to prevent water being splashed round the machine. Cooling by drops of water is harmful, leading to local cooling of the tool tip, and thus to the formation of cracks. A little soda or chromate of potash is added to the water in order to protect the machine from rusting. Oil emulsions should be avoided. Dry grinding requires careful attention and plenty of time particularly in the case of bigger tools and in stronger grinding if cracks should be avoided. Neither must the »Velebit« tool tip be cooled in water because hereby cracks can originate as well.

EDGE HONING

After finish grinding, the »Velebit« tool tip is honed with a silicon carbide whetstone (grain approximately 200) or a diamond hone (Fig. 12). The operation of honing should be watched with a magnifying glass to warrant a smooth cutting edge without indentations.

Honing of cutting edge with whetstone



Dulling of keen-edged tool
For roughing cuts only

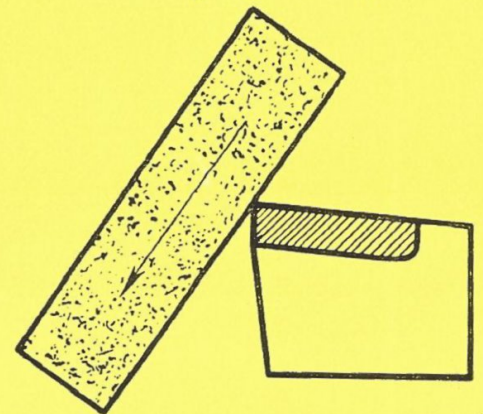


Fig. 12

THE USE OF »VELEBIT« CUTTING TOOLS

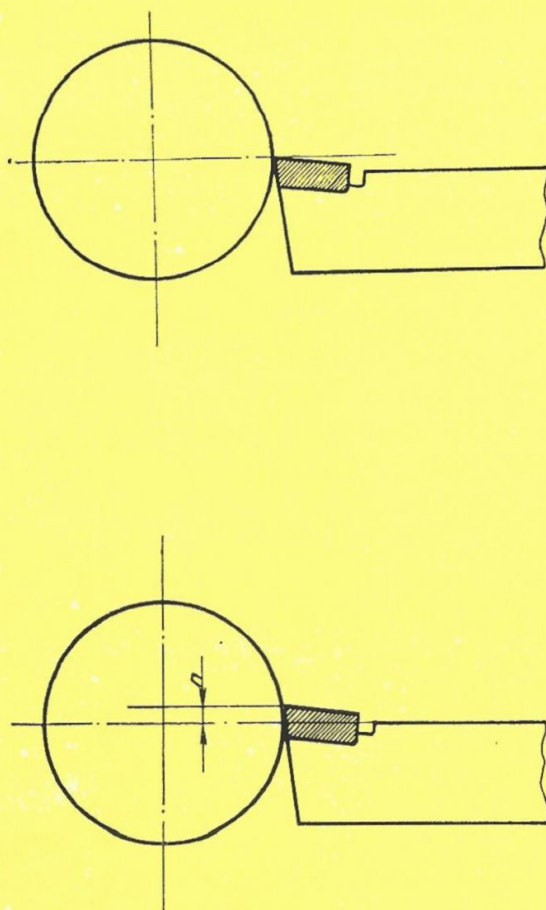


Fig. 13

The usability of cutting tools is versatile. The use of the tools mentioned must be in accordance with the principal technical demands. First of all, the machine tools must be of very rigid design and equipped with a powerful drive free of vibrations.

The tool accessories must be of robust design, this particularly holds good for rigid compound rests and tool posts. In order to prevent vibrations as far as possible an important factor is to use steady rests with free-rolling jaws, and live centers as well. Should the workpiece be of some particular form the tool must be fixed on its free end, and its free end must be somehow supported, too.

In turning various alloyed steels »Velebit« tools should always be set above the center of the workpiece, 1 per cent. higher than the longitudinal axis of the workpiece, whereas for all other lathe tooling the nose of the tool is set exactly at the level of the longitudinal axis of the workpiece (see Fig. 13).

As intermediate under the tool use hardened ground steel. When starting operations »Velebit« tipped tools must be set to full speed, and during operation the cutting speed must not be increased.

For arresting the machine tool the feed must be disconnected or the tool must be withdrawn. It is undesirable and unprofessional to stop the machine tool in action, such a procedure leading to a broken or damaged cutting edge of the tool. Likewise, in planing it is imperative to insure the clearing of the tool in the return action. The modern designs of planers provide the automatic clearance of the tool, thus preventing the material from being damaged. »Velebit« tipped tools are mostly used without cooling. If cooling should be necessary, as in the case of machining special material with high peripheral speed, kerosene or crude oil is often used as coolant. We emphasize that the process of cooling, once used, must be continuous.

But, some operators cool the tool discontinuously, all the same, thus causing changes of temperature and often cracks in the tool. Likewise, it is harmful to the tool to grind it hot. Therefore it is essential completely to cool the tool before grinding. The life of »Velebit« tipped tools entirely depends on the working conditions such as, for instance, cutting speed, chip section, composition of material a. s. o., and on the very workpiece.

It is of particular significance for the life of the tool to know the characteristics of the machine-tool. For the correct use of cemented carbide tools »Velebit« it is imperative to comply with the given instructions which are a constituent of this catalogue, and are contained in special tables. The life of the tool mainly depends on the feed motions and peripheral speeds. The more these items are increased, the more the life of the

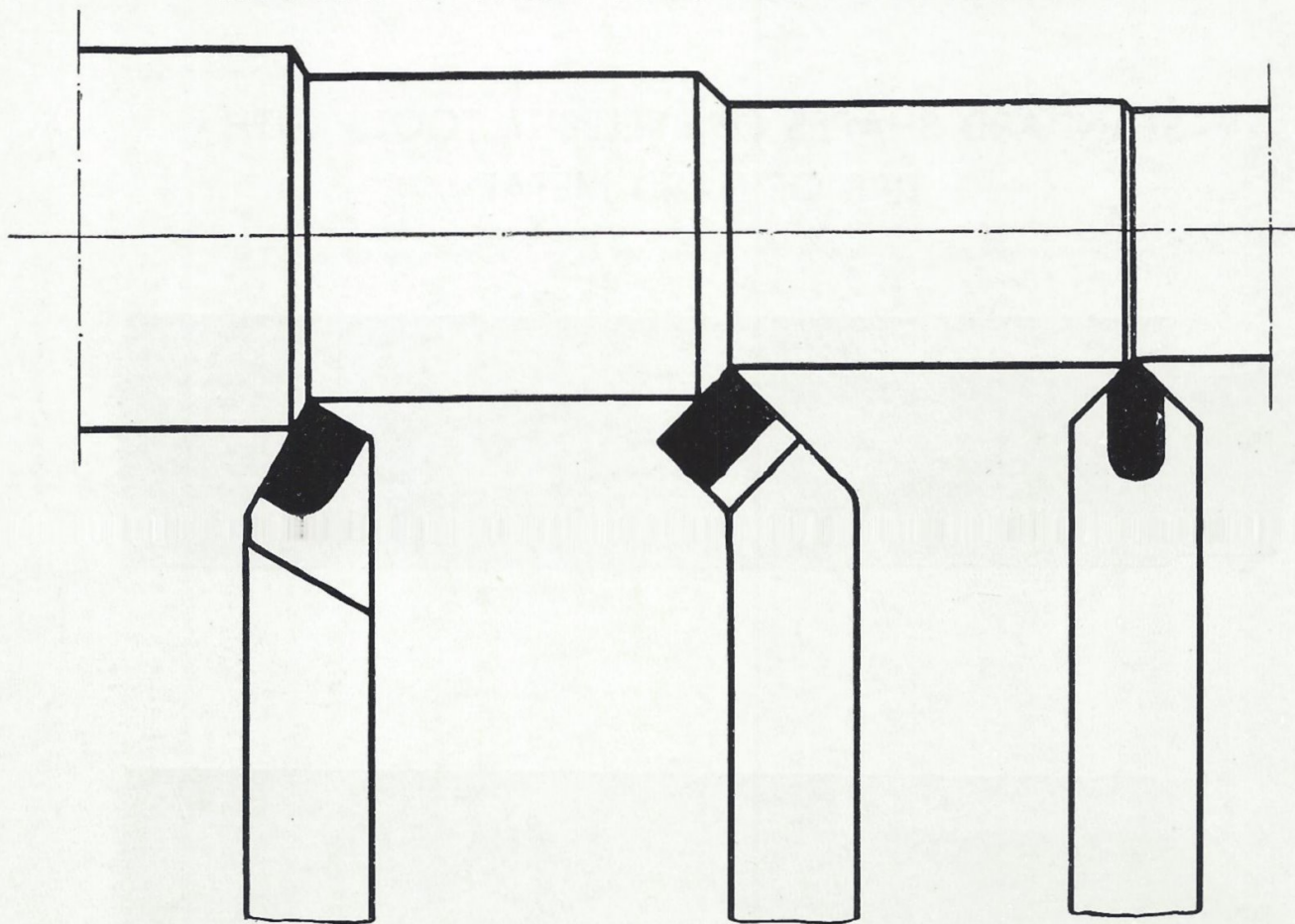
tool is reduced. We emphasize that the peripheral speeds are of particular influence on the life of cemented carbide tools, hence the given instructions should be followed. Too low peripheral speeds, undesirable and harmful to the carbide-tipped tool, may be discerned easily from the unevenly machined surface of the workpiece. In this brief guide general directions are given for the operation with »Velebit« tools.

Detailed and exhaustive instructions are to be found in professional publications, and, on request of our customers, the »Metak« works have pleasure in cooperating theoretically and practically through the intermediary of their specially trained demonstrators.

STANDARD SHAPES OF »VELEBIT« TOOLS WITH
TIPS OF HARD METAL



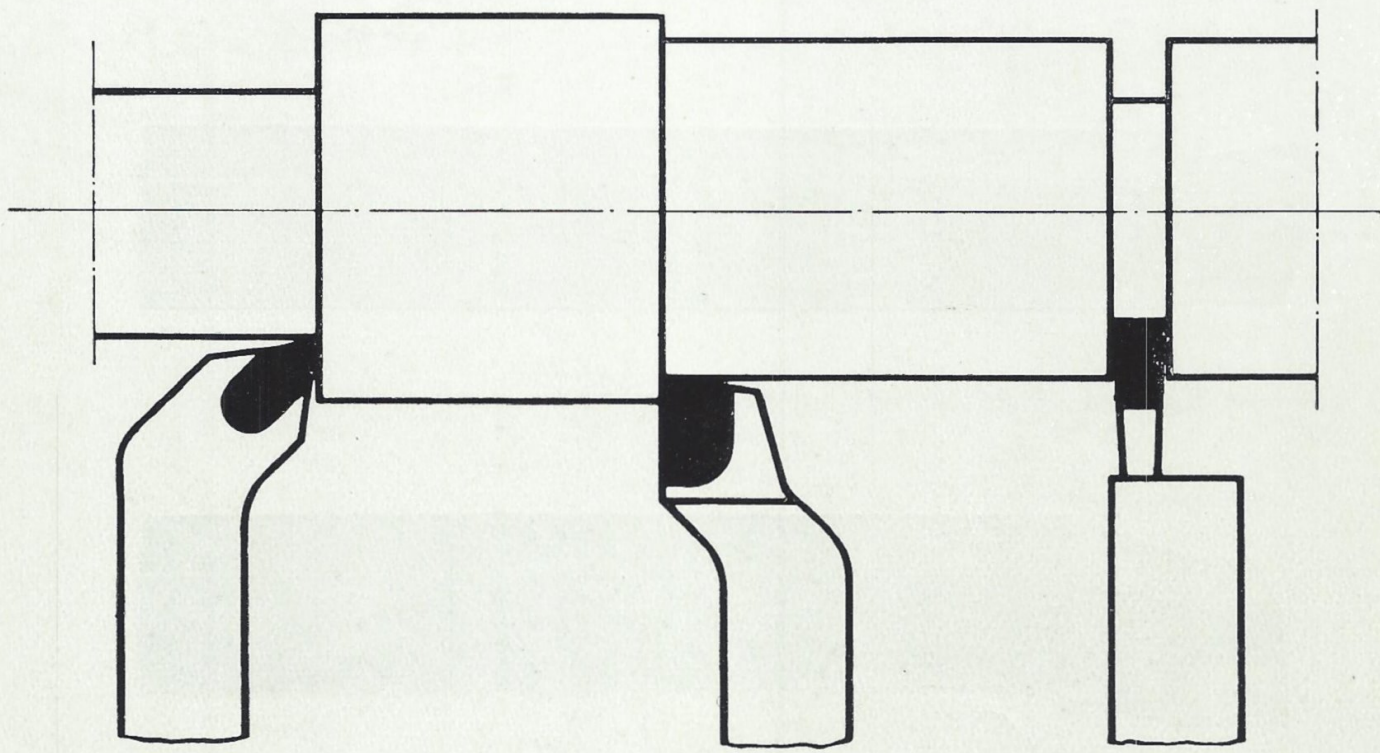
THE SHAPES OF CUTTING TOOLS WITH VELEBIT TOOL TIP



**STRAIGHT
ROUGHING TOOL
(DIN 4971)**

**CRANKED
ROUGHING TOOL
(DIN 4972)**

**STRAIGHT
FINISHING TOOL
(DIN 4975)**

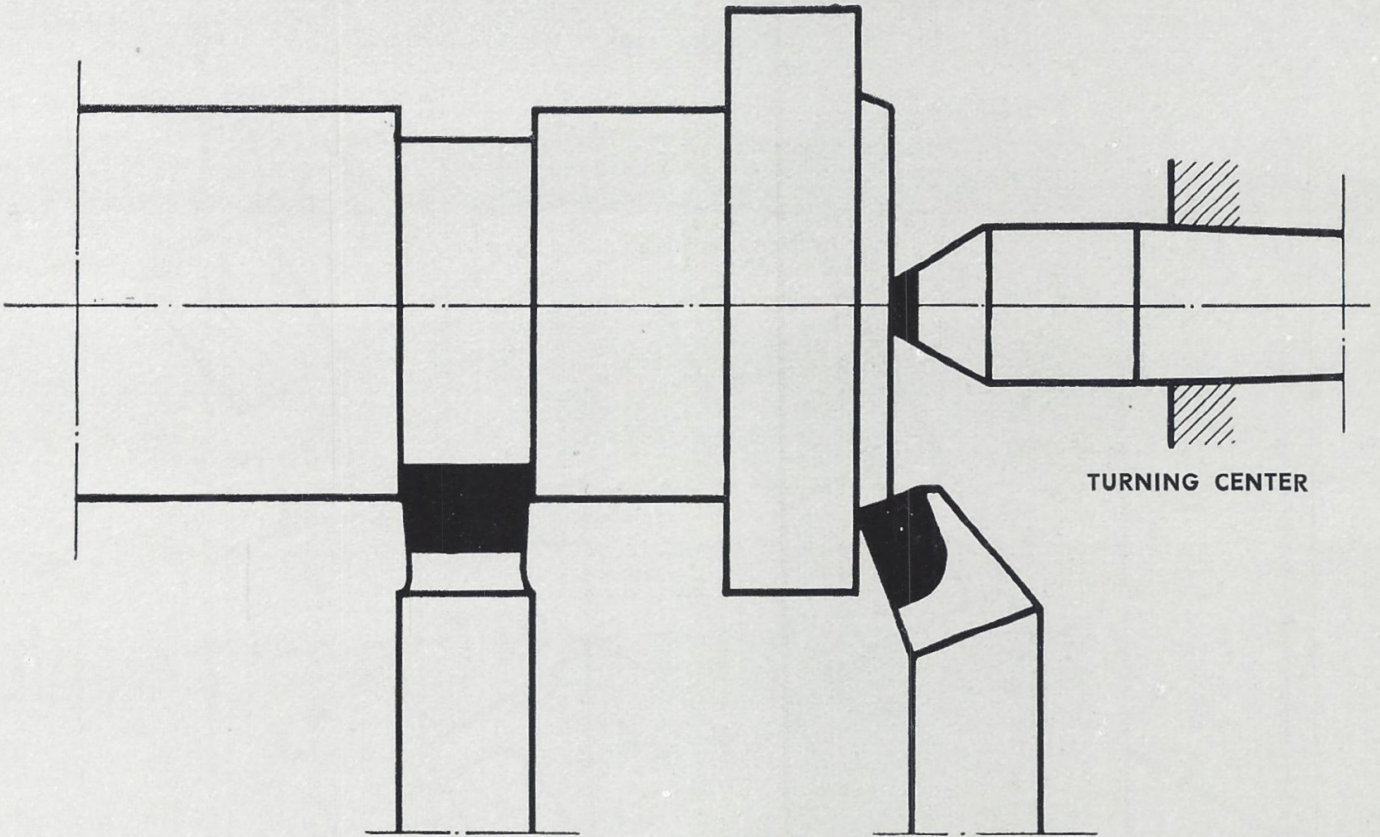


**CRANKED
FINISHING TOOL
(DIN 4978)**

**SIDE TOOL
(DIN 4980)**

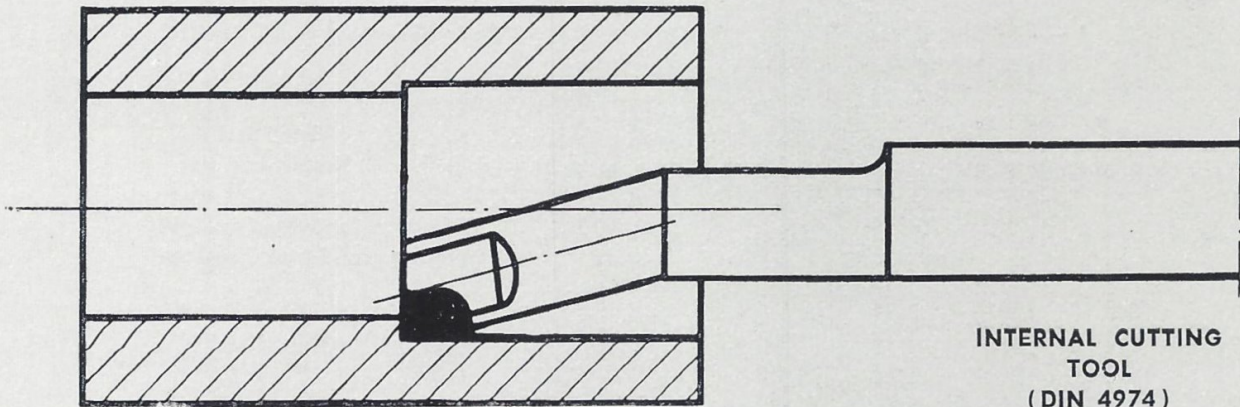
**CUT-OFF TOOL
(DIN 4981)**

THE SHAPES OF CUTTING TOOLS WITH VELEBIT TOOL TIP

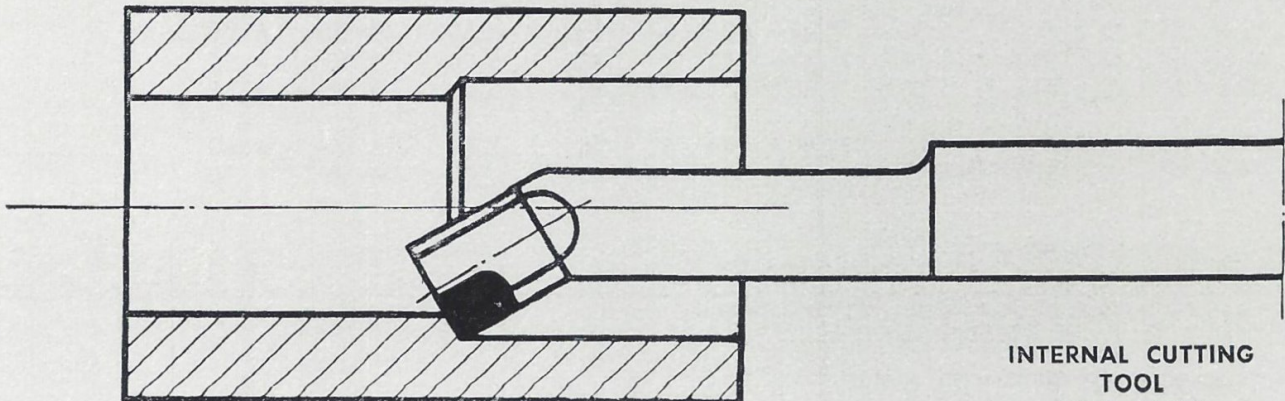


BROAD
FINISHING TOOL
(DIN 4976)

CRANKED
SIDE-CUTTING TOOL
(DIN 4979)



INTERNAL CUTTING
TOOL
(DIN 4974)

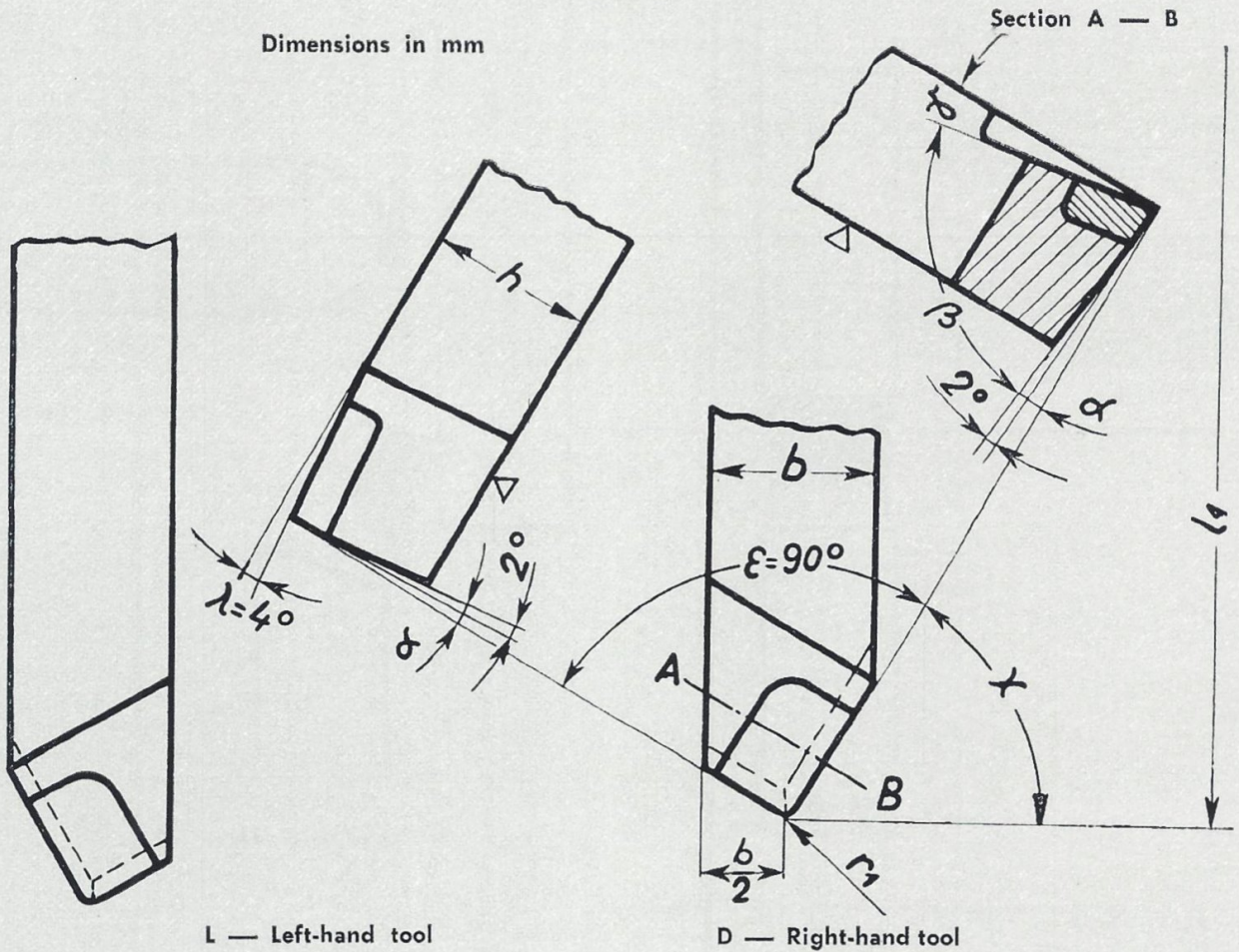


INTERNAL CUTTING
TOOL
(DIN 4973)

STRAIGHT ROUGHING TOOL WITH VELEBIT TOOL TIP

DIN 4971

Dimensions in mm



L — Left-hand tool

D — Right-hand tool

T O O L H O L D E R								Velebit tool tip Shape and size		r ₁ ≈
S Q U A R E				R E C T A N G U L A R				for left- hand tool	for right- hand tool	
Shape	b × h	l l	Weight appro. kg	Shape	b × h	l l	Weight appro. kg			
71.10 q	10 × 10	100	0,11	—	—	—	—	H 8	G 8	0,5
71.12 q	12 × 12	110	0,18	71,16 h	10 × 16	125	0,22	H 10	G 10	
71.16 q	16 × 16	140	0,38	71,20 h	12 × 20	140	0,37	H 12	G 12	
71.20 q	20 × 20	160	0,70	71,25 h	16 × 25	180	0,80	H 16	G 16	
71.25 q	25 × 25	200	1,30	71.32 h	20 × 32	220	1,50	B 20	A 20	1
71.32 q	32 × 32	250	2,70	71.40 h	25 × 40	280	3,00	B 25	A 25	
71.40 q	40 × 40	315	5,20	71,50 h	32 × 50	315	5,30	B 32	A 32	
71.50 q	50 × 50	355	9,20	71,63 h	40 × 63	355	9,40	B 40	A 40	1,6
71.63 q	63 × 63	400	16,50	71,80 h	50 × 80	400	17,00	B 50	A 50	

State with the order :

1. Shape
2. Right-hand type D or left-hand type L
3. Grade of VELEBIT tool tip

Example :

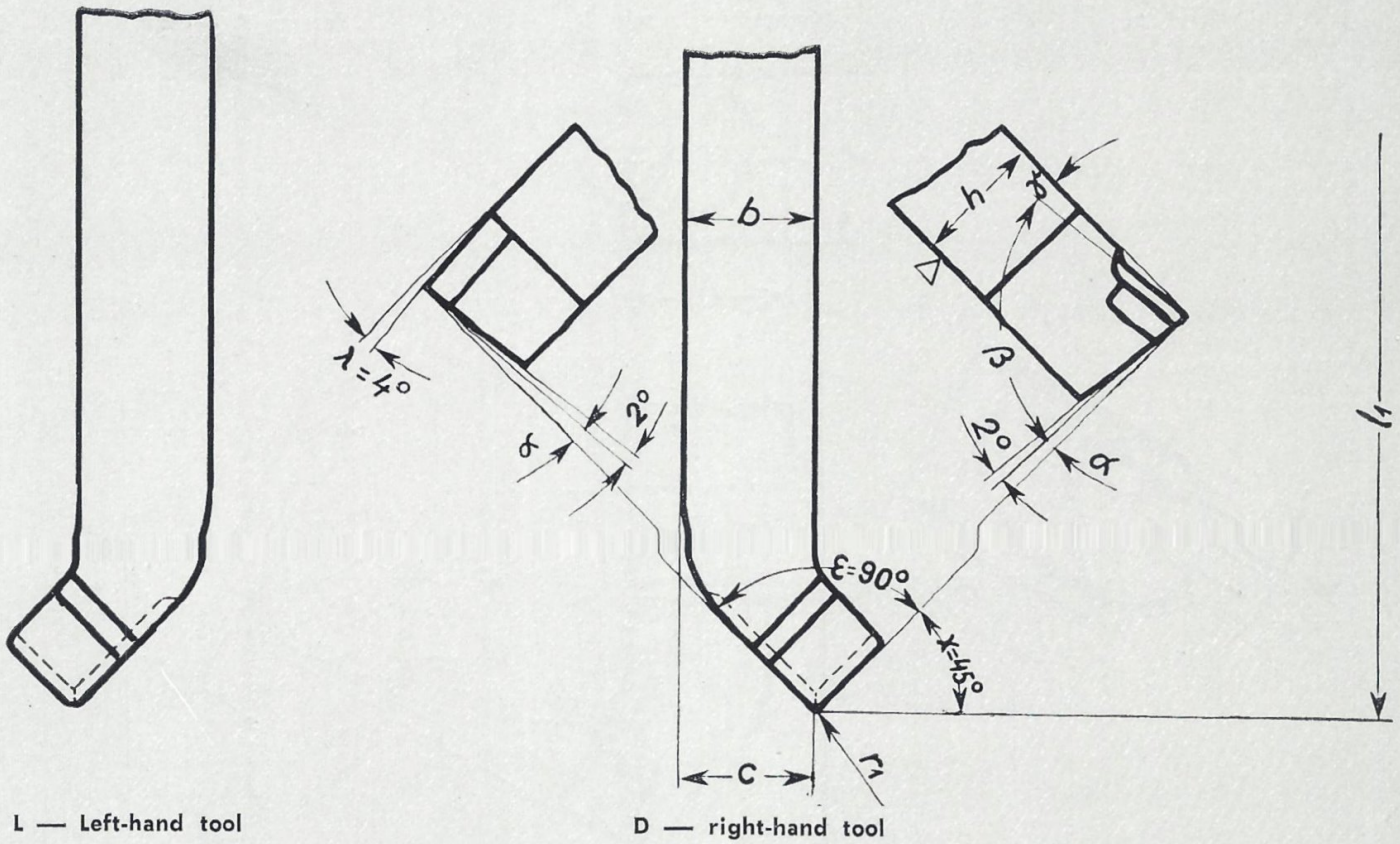
71.16 q L H 1

Normally, we make tools with angles $\alpha=5^\circ$, $\gamma=6^\circ$, $\lambda=4$, and $\kappa=60^\circ$.
Upon customer's request we arrange angles of other values, too.

CRANKED ROUGHING TOOL VELEBIT TIPPED

DIN 4972

Dimensions in mm



T O O L H O L D E R										VELEBIT TOOL TIP	r_1 ≈
S Q U A R E					R E C T A N G U L A R						
Shape	$b \times h$	l_1	c	Weight appro. kg	Shape	$b \times h$	l_1	c	Weight appro. kg	Shape and size	
72.10 q	10 × 10	100	10	0,11	—	—	—	—	—	J 8	0,5
72.12 q	12 × 12	110	12	0,18	72.16 h	10 × 16	125	10	0,22	J 10	
72.16 q	16 × 16	140	16	0,38	72.20 h	12 × 20	140	12	0,37	J 12	
72.20 q	20 × 20	160	20	0,70	72.25 h	16 × 25	180	16	0,80	J 16	
72.25 q	25 × 25	200	25	1,30	72.32 h	20 × 32	220	20	1,50	C 20	1
72.32 q	32 × 32	250	32	2,70	72.40 h	25 × 40	280	25	3,00	C 25	
72.40 q	40 × 40	315	40	5,20	72.50 h	32 × 50	315	32	5,30	C 32	
72.50 q	50 × 50	355	50	9,20	72.63 h	40 × 63	355	40	9,40	C 40	1,6
72.63 q	63 × 63	400	63	16,50	72.80 h	50 × 80	400	50	17,00	C 50	

State with the order:

1. Shape
2. Right-hand type D or left-hand type L
3. Grade of VELEBIT tool tip

Examples:
72.20 h D S 1

Usually, we make tools with angles $\alpha=5^\circ$, $\gamma=6^\circ$, $\lambda=4^\circ$, and $\epsilon=45^\circ$.

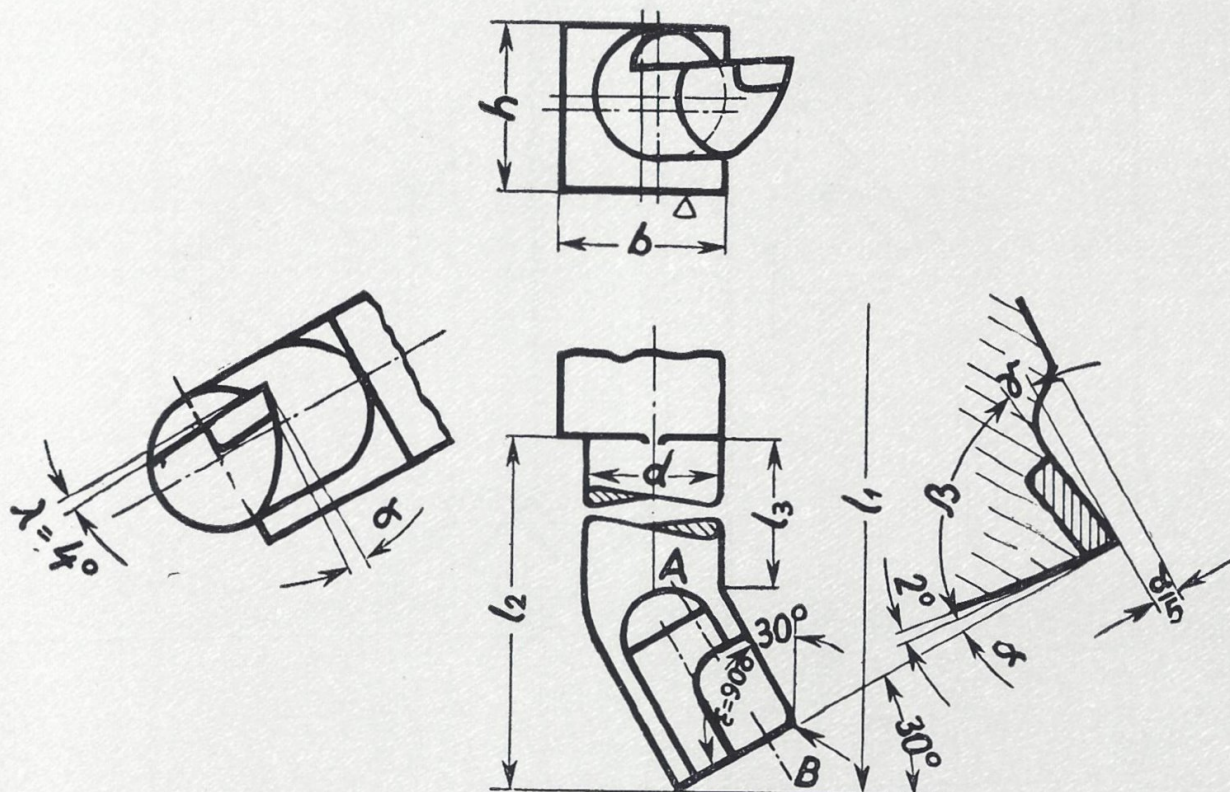
Upon customer's request we arrange angles of other values, too.

INTERNAL TOOL VELEBIT TIPPED

DIN 4973

Dimensions in mm

Section A — B



T O O L H O L D E R												VELEBIT tool tip	r_1 ≈	Minimum diameter of bore machinable
S Q U A R E							R O U N D				Shape and size			
Shape	$b \times h$	l_1	l_2	l_3	d	Weight appro. kg	Shape	d	l_1	Weight appro. kg				
73.10 q	10 × 10	125	32	20	8	0,14	—	—	—	—	G 6	0,5	15	
73.12 q	12 × 12	140	40	25	10	0,21	73.10 r	10	160	0,14	G 8	0,5	20	
73.16 q	16 × 16	180	50	32	12	0,48	73.12 r	12	180	0,22	G 8	0,5	22	
73.20 q	20 × 20	220	80	56	16	0,90	73.16 r	16	220	0,45	G 10	0,5	30	
73.25 q	25 × 25	250	100	70	20	1,60	73.20 r	20	250	0,80	G 12	1	36	
—	—	—	—	—	—	—	73.25 r	25	315	1,60	G 16	1	44	
—	—	—	—	—	—	—	73.32 r	32	355	2,90	A 20	1	56	

State with the order :

1. Shape
2. Grade of VELEBIT tool tip

Example :

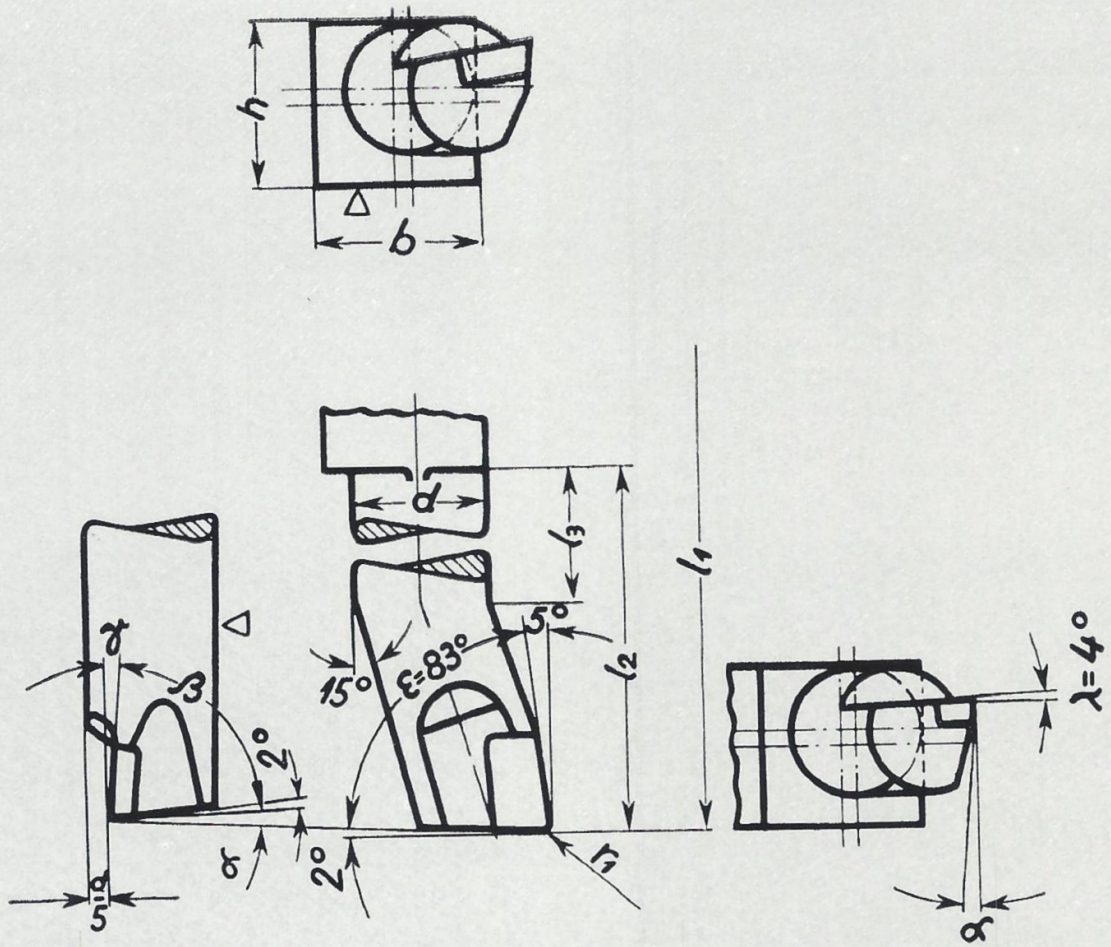
73.12 q S 2

Usually we make tools with angles $\alpha = 5^\circ$, $\gamma = 6^\circ$, $\lambda = 4^\circ$, and $\zeta = 30^\circ$.
Upon customer's request we make tools of other values, too.

INTERNAL TOOL VELEBIT TIPPED

DIN 4974

Dimensions in mm



T O O L H O L D E R											VELEBIT tool tip	r ₁	Minimum diameter of machinable bore	
S Q U A R E						R O U N D				Shape and size				
Shape	b × h	l ₁	l ₂	l ₃	d	Weight appro. kg	Shape	d	l ₁		Weight appro. kg			
74.10 q	10 × 10	125	32	12	8	0,14	—	—	—	—	G 6	0,5	15	24
74.12 q	12 × 12	140	40	16	10	0,21	74.10 r	10	160	0,14	G 8		20	30
74.16 q	16 × 16	180	50	20	12	0,48	74.12 r	12	180	0,22	G 8	1	22	40
74.20 q	20 × 20	220	80	40	16	0,90	74.16 r	20	220	0,45	G 10		30	50
74.25 q	25 × 25	250	100	50	20	1,60	74.20 r	20	250	0,80	G 12	1	36	62
—	—	—	—	—	—	—	74.25 r	25	315	1,60	G 16		44	78
—	—	—	—	—	—	—	74.32 r	32	355	2,90	A 20		56	100

State with the order :

1. Shape
2. Grade of VELEBIT tool tip

Example :

74.10 r H 1

Normally we make tools with angles $\alpha=5^\circ$, $\gamma=6^\circ$, and $\lambda=4^\circ$.

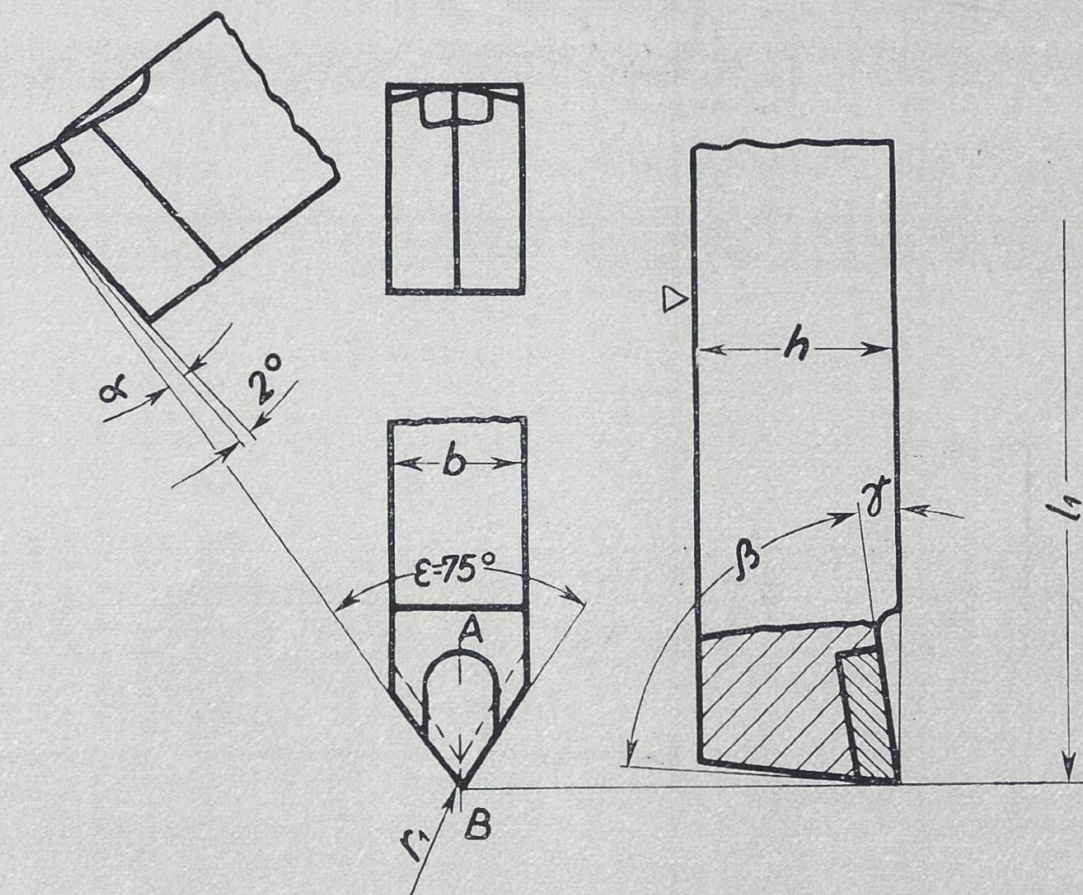
Upon customer's request we arrange angles of other values, too.

STRAIGHT FINISHING TOOL VELEBIT TIPPED

DIN 4975

Dimensions in mm

Section A — B



T O O L H O L D E R								VELEBIT tool tip	r_1 ≈
S Q U A R E				R E C T A N G U L A R					
Shape	$b \times h$	l_1	Weight approx. kg	Shape	$b \times h$	l_1	Weight approx. kg	Shape and size	
75.10 q	10 × 10	100	0,11	—	—	—	—	F 4	0,5
75.12 q	12 × 12	110	0,18	75.16 h	10 × 16	125	0,22	F 5	
75.16 q	16 × 16	140	0,38	75.20 h	12 × 20	140	0,37	F 6	
75.20 q	20 × 20	160	0,70	75.25 h	16 × 25	180	0,80	F 8	
75.25 q	25 × 25	200	1,30	75.32 h	20 × 32	220	1,50	F 10	1
75.32 q	32 × 32	250	2,70	75.40 h	25 × 40	280	3,00	F 12	

State with the order :

1. Shape
2. Grade of VELEBIT tool tip

Example :

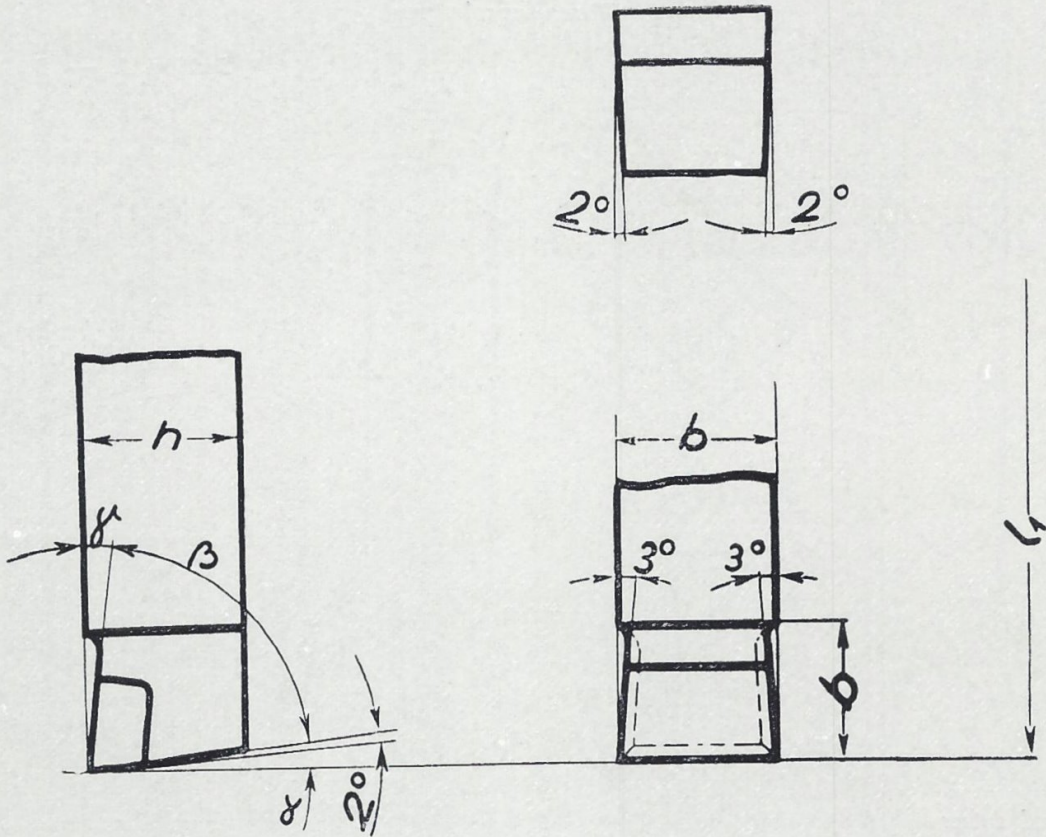
75.40 h-S 2

Usually we make tools with angles $\alpha=5^\circ$ and $\gamma=6^\circ$.
Upon customer's request we arrange angles of other values, too.

BROAD FINISHING TOOL VELEBIT TIPPED

DIN 4976

Dimensions in mm



T O O L H O L D E R								VELEBIT tool tip
S Q U A R E				R E C T A N G U L A R				
Shape	b × h	l ₁	Weight appro. kg	Shape	b × h	l ₁	Weight appro. kg	Shape and size
76.10 q	10 × 10	100	0,11	76.16 h	10 × 16	125	0,22	J 10
76.12 q	12 × 12	110	0,18	76.20 h	12 × 20	140	0,37	J 12
76.16 q	16 × 16	140	0,38	76.25 h	16 × 25	180	0,80	J 16
76.20 q	20 × 20	160	0,70	76.32 h	20 × 32	220	1,50	C 20
76.25 q	25 × 25	200	1,30	76.40 h	25 × 40	280	3,00	C 25
76.32 q	32 × 32	250	2,70	76.50 h	32 × 50	315	5,30	C 32
76.40 q	40 × 40	315	5,20	76.63 h	40 × 63	355	9,40	C 40
76.50 q	50 × 50	355	9,20	76.80 h	50 × 80	400	17,00	C 50

State with the order :

1. Shape
2. Grade of VELEBIT tool tip

Example :

76.40 q S 1

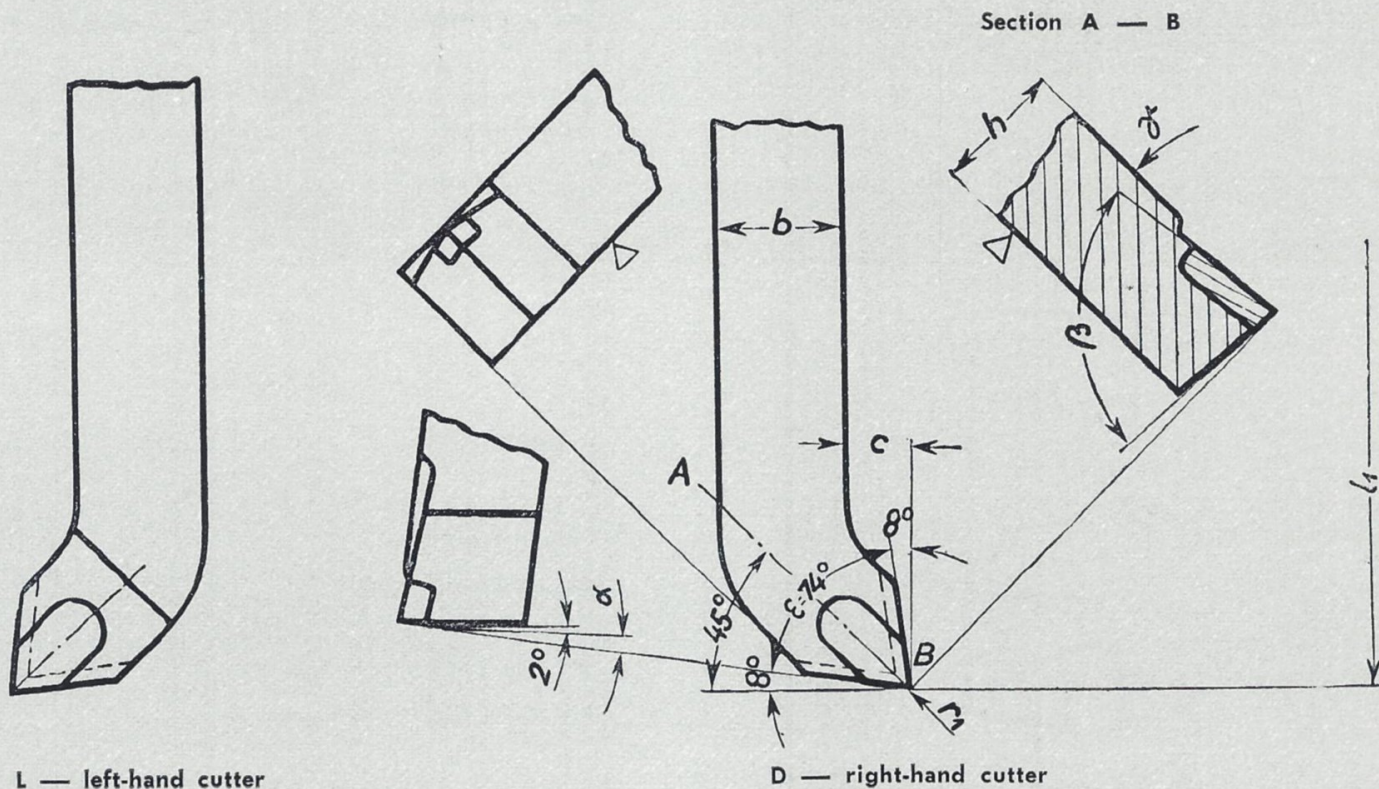
Usually we make tools with angles $\alpha=5^\circ$ and $\gamma=6^\circ$.

Upon customer's request we arrange angles of other values, too.

CRANKED FINISHING TOOL VELEBIT TIPPED

DIN 4978

Dimensions in mm



L — left-hand cutter

D — right-hand cutter

T O O L H O L D E R										VELEBIT TOOL TIP	r_1
S Q U A R E					R E C T A N G U L A R						
Shape	$b \times h$	l_1	c	Weight appro. kg	Shape	$b \times h$	l_1	c	Weight appro. kg	Shape and size	
78.10 q	10 × 10	100	8	0,11	—	—	—	—	—	F 4	0,5
78.12 q	12 × 12	110	9	0,18	78.16 h	10 × 16	125	9	0,22	F 5	
78.16 q	16 × 16	140	10	0,38	78.20 h	12 × 20	140	10	0,37	F 6	
78.20 q	20 × 20	160	12	0,70	78.25 h	16 × 25	180	12	0,80	F 8	
78.25 q	25 × 25	200	14	1,30	78.32 h	20 × 32	220	14	1,50	F 10	1
78.32 q	32 × 32	250	16	2,70	78.40 h	25 × 40	280	16	3,00	F 12	

State with the order :

1. Shape
2. Right-hand tool D or left-hand-tool L
3. Grade of VELEBIT tool tip

Examples :
78.32 q D S 1

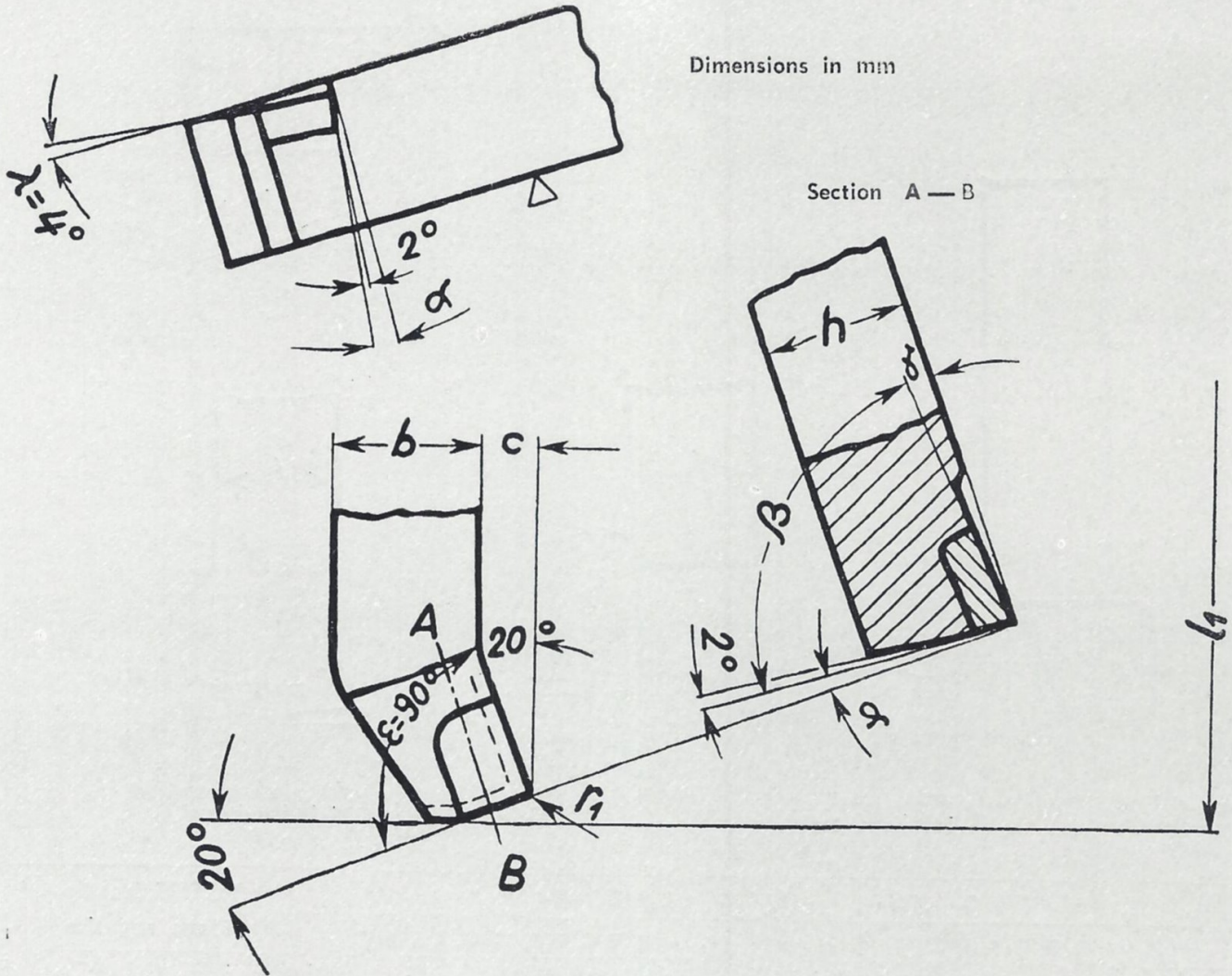
Usually we make tools with angles $\alpha = 5^\circ$, $\gamma = 6^\circ$.

Upon customer's request we arrange angles of other values, too.

CRANKED FACING TOOL VELEBIT TIPPED

DIN 4979

Dimensions in mm



T O O L H O L D E R										VELEBIT tool tip		r ₁
S Q U A R E					R E C T A N G U L A R					Shape and size		
Shape	b × h	l ₁	c	Weight approx. kg	Shape	b × h	l ₁	c	Weight approx. kg	for left-hand cutter	for right-hand cutter	
79.10 q	10 × 10	100	4	0,11	—	—	—	—	—	H 8	G 8	0,5
79.12 q	12 × 12	110	5	0,18	79.16 h	10 × 16	125	5	0,22	H 10	G 10	
79.16 q	16 × 16	140	6	0,38	79.20 h	12 × 20	140	6	0,37	H 12	G 12	
79.20 q	20 × 20	160	8	0,70	79.25 h	16 × 25	180	8	0,80	H 16	G 16	
79.25 q	25 × 25	200	10	1,30	79.32 h	20 × 32	220	10	1,50	B 20	A 20	1
79.32 q	32 × 32	250	12	2,70	79.40 h	25 × 40	280	12	3,00	B 25	A 25	

State with the order:

1. Shape
2. Right-hand type D or left-hand type L
3. Grade of VELEBIT tool tip

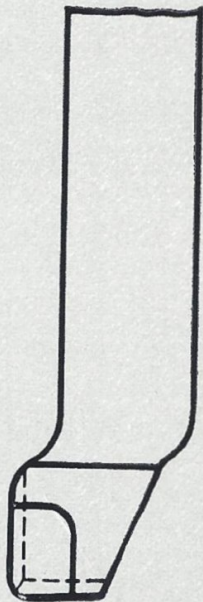
Example:
79.40 h L S 1

Usually we make tools with angles $\alpha=5^\circ$, $\gamma=6^\circ$, $\lambda=4^\circ$.
Upon customer's request we arrange angles of other values, too.

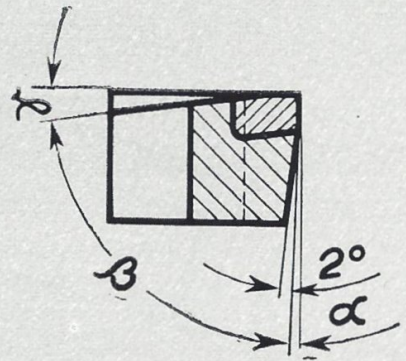
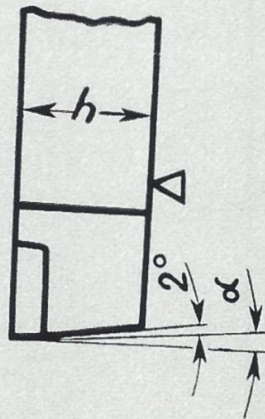
SIDE TOOL VELEBIT TIPPED

DIN 4980

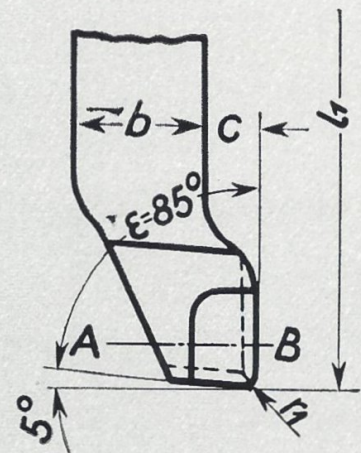
Dimensions in mm



L — Left-hand tool



R — Right-hand tool



T O O L H O L D E R										VELEBIT tool tip Shape and size		r_1
S Q U A R E					R E C T A N G U L A R					for left-hand cutter	for right-hand cutter	
Shape	$b \times h$	r_1	c	Weight kg appo.	Shape	$b \times h$	l_1	c	Weight appo. kg			
80.10 q	10 × 10	100	4	0,11	—	—	—	—	—	H 8	G 8	0,5
80.12 q	12 × 12	110	5	0,18	80.16 h	10 × 16	125	4	0,22	H 10	G 10	
80.16 q	16 × 16	140	6	0,38	80.20 h	12 × 20	140	5	0,37	H 12	G 12	
80.20 q	20 × 20	160	8	0,70	80.25 h	16 × 25	180	6	0,80	H 16	G 16	
80.25 q	25 × 25	200	10	1,30	80.32 h	20 × 32	220	8	1,50	B 20	A 20	1
80.32 q	32 × 32	250	12	2,70	80.40 h	25 × 40	280	10	3,00	B 25	A 25	
80.40 q	40 × 40	315	14	5,20	80.50 h	32 × 50	315	12	5,30	B 32	A 32	
80.50 q	50 × 50	355	16	9,20	80.63 h	40 × 63	355	14	9,40	B 40	A 40	1,6

State with the order :

1. Shape
2. D right-hand or L left-hand type
3. Grade of VELEBIT tool tip

Exemple :

80.16 h D S 1

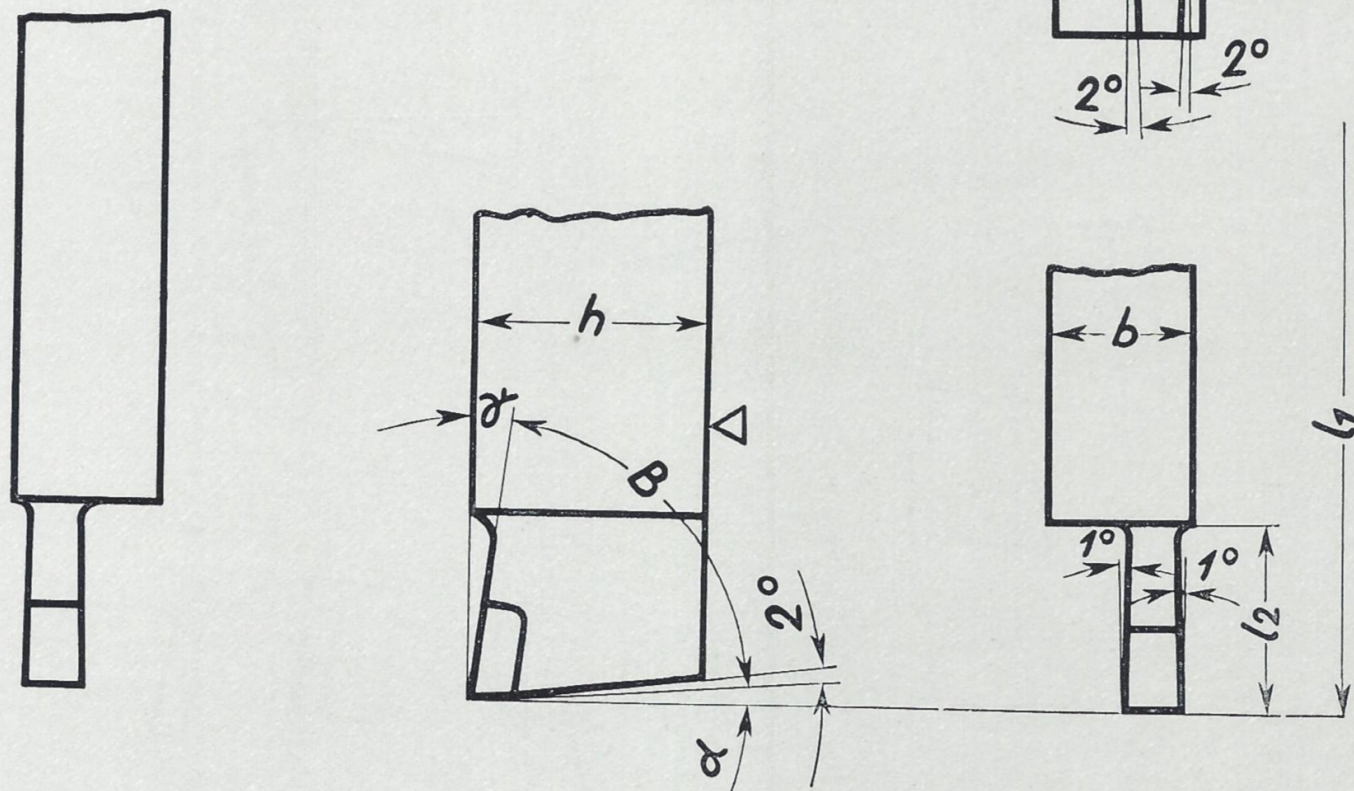
Normally we make tools with angles $\alpha = 5^\circ$ and $\gamma = 6^\circ$.

Upon customer's request we make tools of other values, too.

CUT-OFF TOOL VELEBIT TIPPED

DIN 4981

Dimensions in mm



L — left-hand cutter

D — right-hand cutter

T O O L H O L D E R					VELEBIT tool tip
R E C T A N G U L A R					
Shape	$b \times h$	l_1	l_2	Weight appro. kg	Shape and size
81.10 h	6×10	100	10	0,70	D 3
81.12 h	8×12	110	10	0,12	D 3
81.16 h	10×16	125	12	0,22	D 3
81.20 h	12×20	140	15	0,37	D 4
81.25 h	16×25	180	20	0,80	D 5
81.32 h	20×32	220	25	1,50	D 6
81.40 h	25×40	280	32	3,00	D 8
81.50 h	32×50	315	40	5,30	D 10

State with the order :

1. Shape

2. Right-hand tool D or left-hand tool L

3. Grade of VELEBIT tool tip

Example :

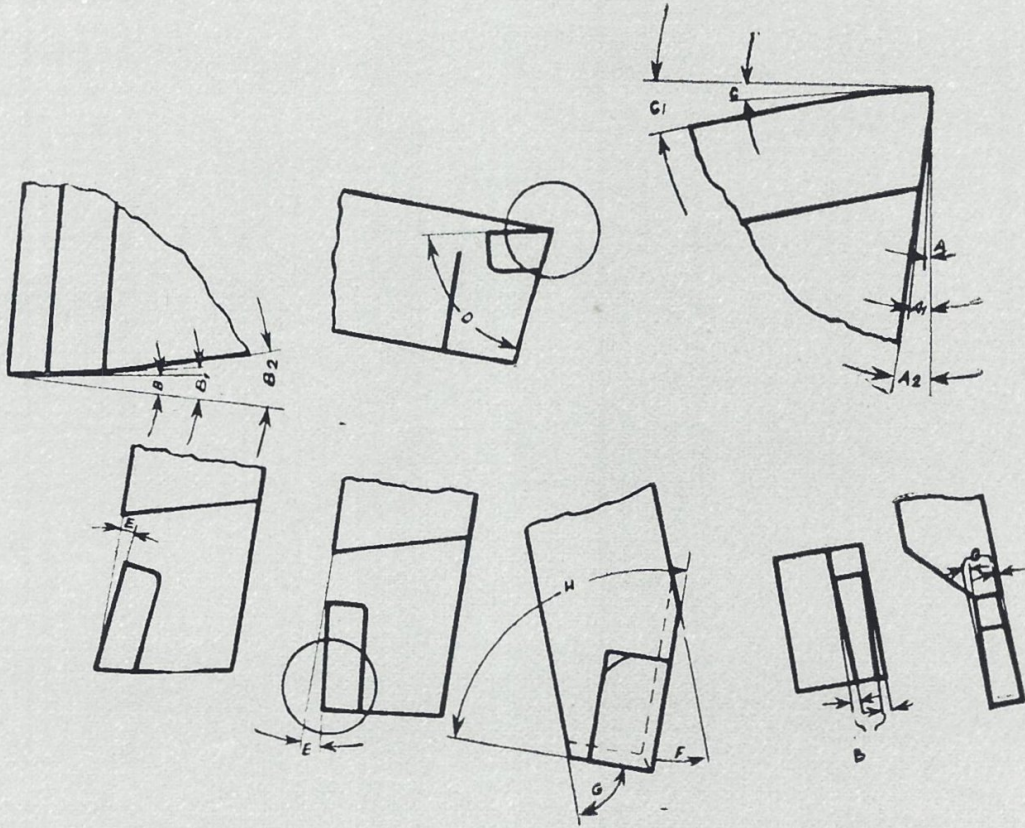
81.32 h L S 2

Usually we make tools with angles $\alpha=5^\circ$, $\gamma=6^\circ$.

Upon customer's request we make tools of other values, too.

TOOL ANGLES AFTER PROPOSAL OF WORKING GROUP

ISO/TC 29/GT9



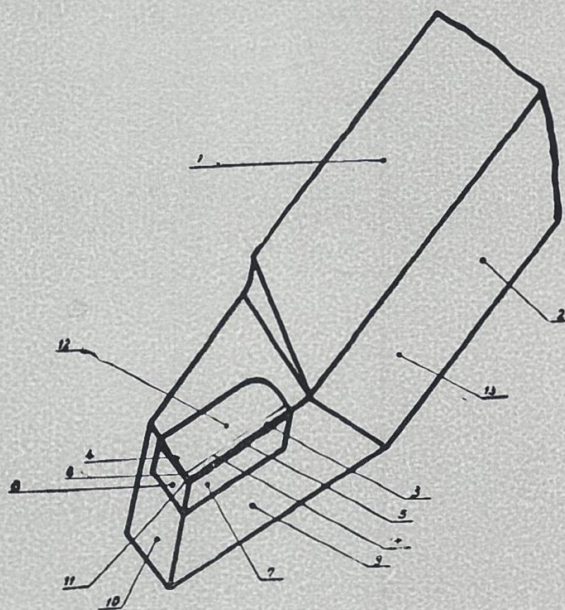
Angle A	Back angle of facet
Angle A1	Back angle of tool tip
Angle A2	Back angle of shank
Angle B	Back angle of secondary facet
Angle B1	Back angle of flank of tool tip
Angle B2	Back angle of flank of shank
Angle C	Front angle of front facet
Angle C1	Front angle of face
Angle D	Lip angle
Angle E	Angle of inclination of cutting edge
Angle F	Plan angle of cutting edge
Angle G	Plan angle of edge of flank
Angle H	Nose angle

The front angle is positive if the face rises towards the cutting edge, and negative if the face slopes towards the cutting edge.

The angle of inclination of the cutting edge is positive if the cutting edge rises towards the nose, and negative if the cutting edge slopes towards the nose.

PARTS AND EDGES OF CUTTING TOOLS AFTER PROPOSAL OF WORKING GROUP

ISO/TC29/GT9

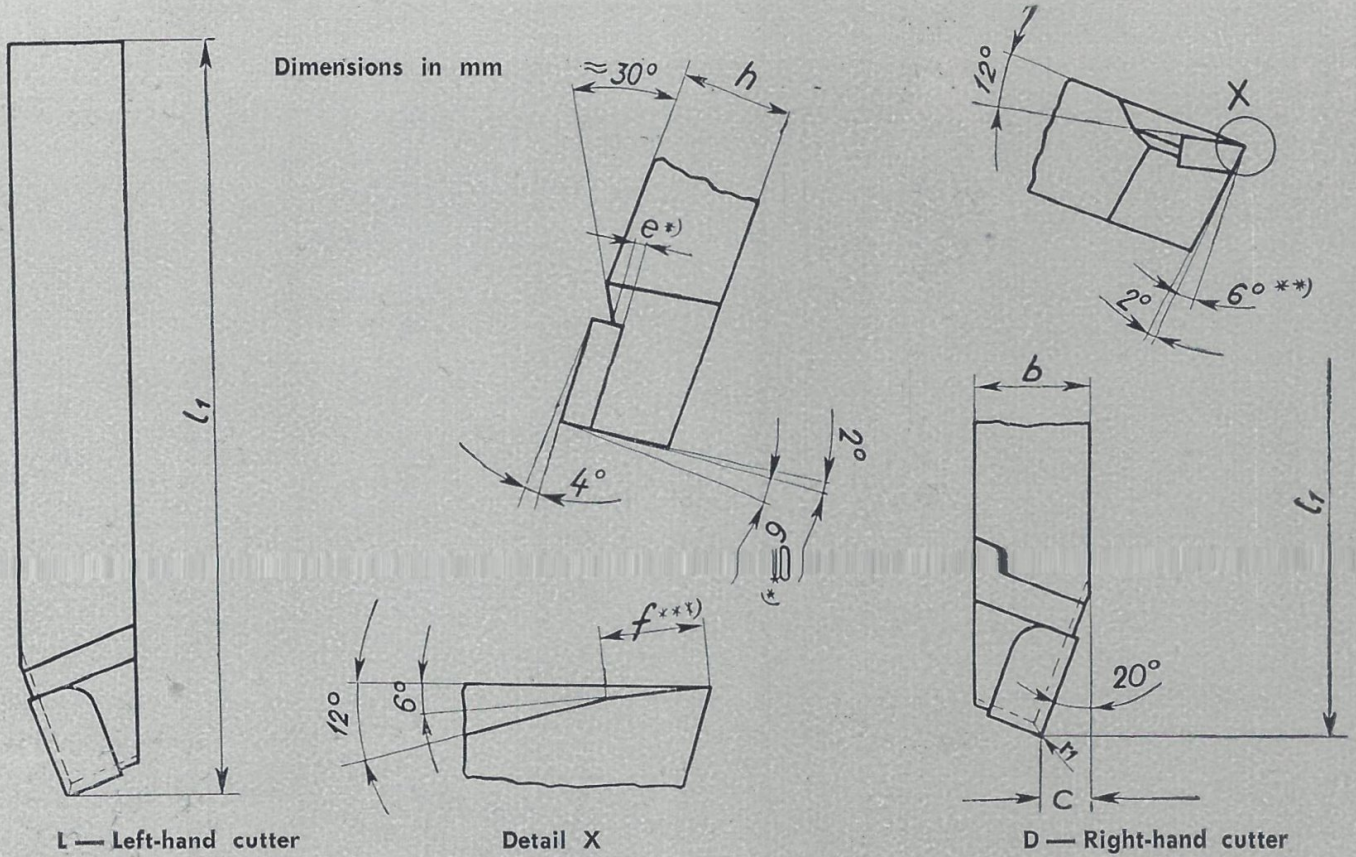




1. Shank
2. Bearing-surface
3. Cutting edge
4. Edge of flank
5. Back facet
6. Back secondary facet
7. Main back of tool tip
8. Secondary back of tool tip
9. Back of shank
10. Secondary back of shank
11. Nose
12. Face
13. Flank of shank
14. Front facet

STRAIGHT TOOL VELEBIT TIPPED

DIN 4971 After ISO 1

With tools of shank section 10 q and 12 q the tool tip is inserted with its entire thickness into the shank, whereas with the other sections partially only.*)



Section of shank	Symbol of shank	h	b	c ≈	l ₁ + 5%	r ≈	Tool tip	
							for left-hand cutter	for right-hand cutter
q = square 	10 q	10	10	4	90	0,5	B 8	A 8
	12 q	12	12	5	100	0,5	B 10	A 10
	16 q	16	16	6	110	0,5	B 12	A 12
	20 q	20	20	8	125	0,5	B 16	A 16
	25 q	25	25	10	140	1	B 20	A 20
	32 q	32	32	12	170	1	B 25	A 25
	40 q	40	40	16	200	1	B 32	A 32
	50 q	50	50	20	240	1,6	B 40	A 40
	63 q ¹⁾	63	63	25	— ¹⁾	1,6	B 50	A 50
h = rectangular 	20 h	20	12	5	125	0,5	B 12	A 12
	25 h	25	16	6	140	0,5	B 16	A 16
	32 h	32	20	8	170	0,5	B 20	A 20
	40 h	40	25	10	200	1	B 25	A 25
	50 h	50	32	12	240	1	B 32	A 32
	63 h	63	40	16	280	1	B 40	A 40

*) insertion depth $e \approx 0,4 \times$ thickness s of tool tip after DIN 4950 (ISO).

**) Clearance angle of 6° is valid for back face of tool tip. Clearance angle of facet is 1° smaller.

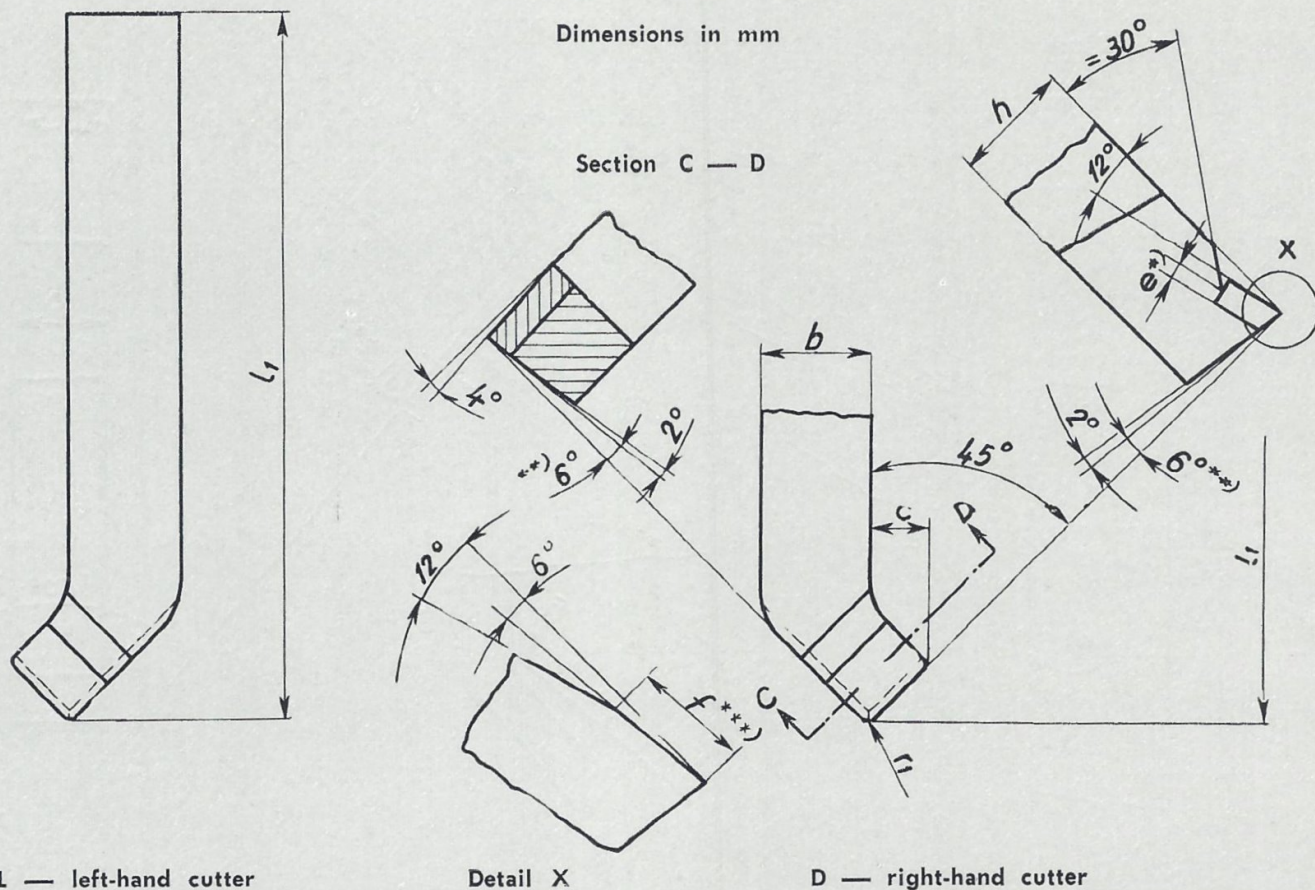
***) Width of front facet $f \approx 0,2 \times$ width t of tool tip after DIN 4950 (ISO).


1) Tools of those sizes are designed for special purposes. The given dimensions serve as guides for the design of tools. When the quoted sizes are demanded length l_1 must be given with the order.

CRANKED VELEBIT TIPPED TOOL

DIN 4972 after ISO 2

With tools of shank section 10 q and 12 q the tool tip is inserted with its entire thickness into the shank, whereas with the other sections partially only.*)



Shank section	Symbol of shank	h	b	c	l_1 +5%	r_1	Tool tip
 q = square shank	10 q	10	10	6	90	0,5	C 8
	12 q	12	12	7	100	0,5	C 10
	16 q	16	16	8	110	0,5	C 12
	20 q	20	20	10	125	0,5	C 16
	25 q	25	25	12	140	1	C 20
	32 q	32	32	14	170	1	C 25
	40 q	40	40	18	200	1	C 32
	50 q	50	50	22	240	1,6	C 40
	63 q ¹⁾	63	63	25	— ¹⁾	1,6	C 50

*) Insertion depth $e \approx 0,4 \times$ thickness s of tool tip after DIN 4950 (ISO).

***) Clearance angle of 6° is valid for back face of tool tip. Clearance angle of facet is 1° smaller.

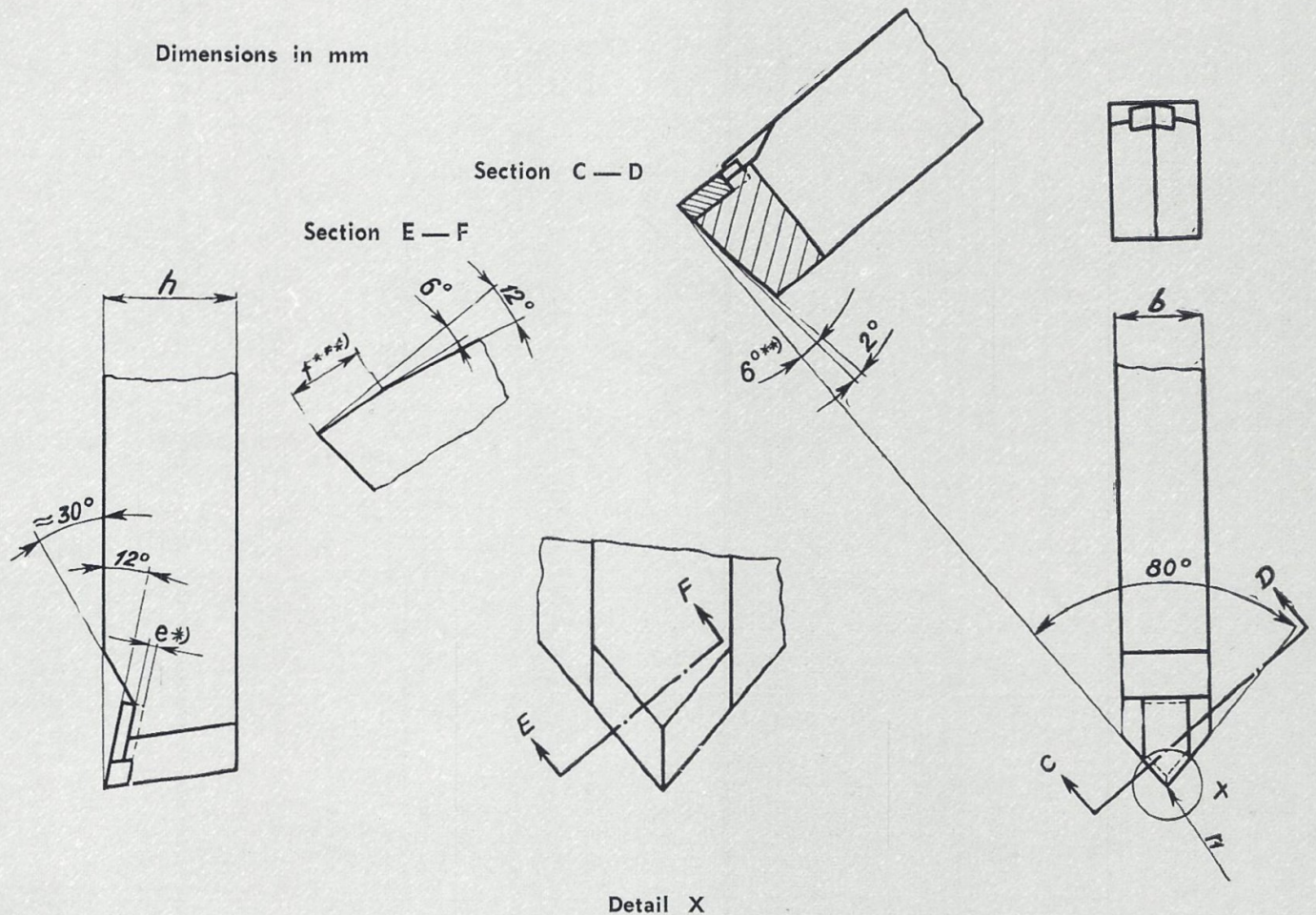
***) Width of front facet $f \approx 0,2 \times$ width of tool tip after DIN 4950 (ISO).


¹⁾ Tools of those sizes are designed for special purposes. The given dimensions serve as guides for the design of tools. When the quoted sizes are demanded length l_1 must be given with the order.

POINT TOOL VELEBIT TIPPED

DIN 4975

With tools of shank section 16 h and 20 h the tool tip is inserted into the shank with its entire thickness whereas with the other sections partially only.*)



Section of shank	Symbol of shank	h	b	l_1 + 5%	r_1 ≈	Tool tip
h = rectangular shank 	16 h	16	10	110	0,5	E 5
	20 h	20	12	125	0,5	E 6
	25 h	25	16	140	0,5	E 8
	32 h	32	20	170	1	E 10
	40 h	40	25	200	1	E 12

*) Insertion depth $e \approx 0,4 \times$ thickness s of tool tip after DIN 4950 (ISO).

**) Clearance angle of 6° is valid for back face of tool tip. Clearance angle of facet is 1° smaller.

***) Width of front facet $f \approx 0,15 \times$ length of tool tip t after DIN 4950 (ISO).

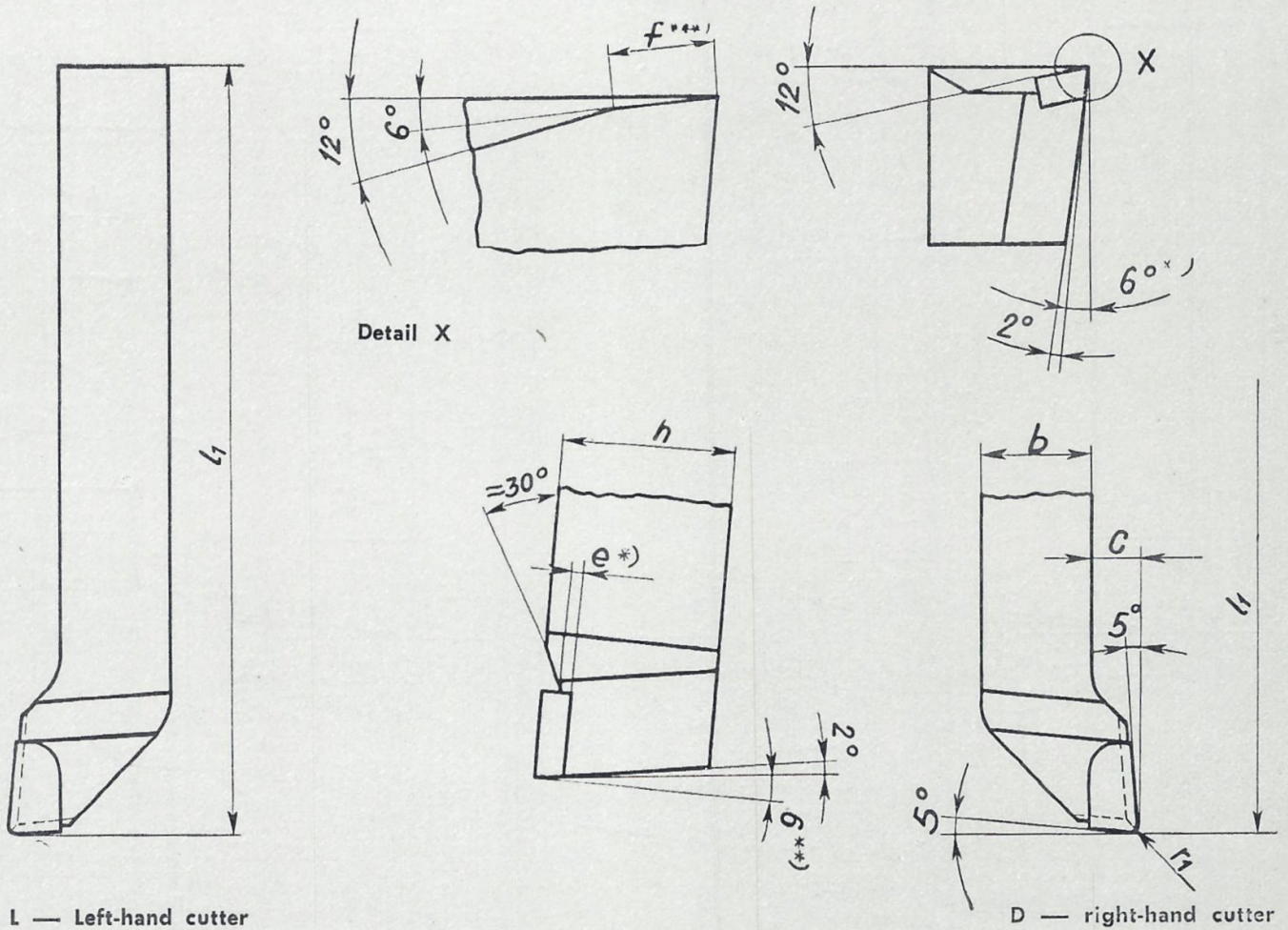
1) Tools of those sizes are designed for special purposes. The given dimensions serve as guides for the design of tools. When the quoted sizes are demanded length l_1 must be given with the order.

ANGULAR FACING TOOL VELEBIT TIPPED

DIN 4978 After ISO 3


With tools of shank section 16 h and 20 h the tool tip is inserted with its full thickness into the shank whereas with the other sections partially only.*)

Dimensions in mm



L — Left-hand cutter

D — right-hand cutter

Shank section	Symbol of shank	h	b	c	l_1 + 5%	r_1	Tool tip	
							for left-hand tool	for right-hand tool
h = rectangular shank 	16 h	16	10	5	110	0,5	B 8	A 8
	20 h	20	12	6	125	0,5	B 10	A 10
	25 h	25	16	8	140	0,5	B 12	A 12
	32 h	32	20	10	170	0,5	B 16	A 16
	40 h	40	25	12	200	1	B 20	A 20
	50 h	50	32	14	240	1	B 25	A 25

*) Insertion depth $e \approx 0,4 \times$ thickness s of tool tip after DIN 4950 (ISO).

**) Clearance angle of 6° is valid for back face of tool tip. Clearance angle of facet is 1° smaller.

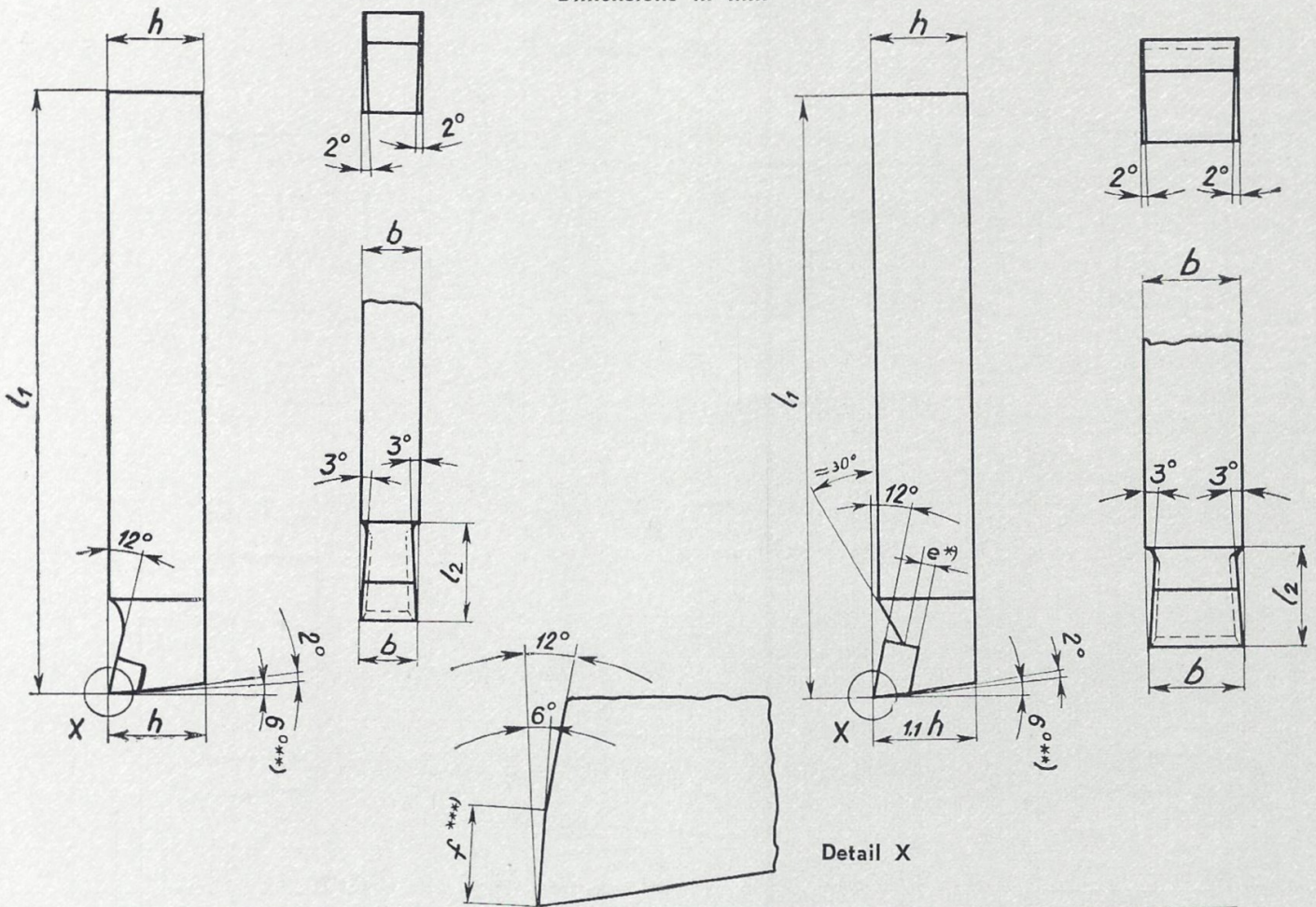
***) Width of front facet $f \approx 0,2 \times$ width t of tool tip after DIN 4950 (ISO).



BROAD TOOL VELEBIT TIPPED

DIN 4976 After ISO 4

With tools of shank section 16 h and 20 h the tool tip is inserted with its full thickness into the shank whereas with the other sections partially only.*)

Dimensions in mm



Section of shank	Symbol of shank	h	b	i_1 + 5%	i_2 ≈	Tool tip
q = square shank 	10 q	10	10	90	10	C 10
	12 q	12	12	100	12	C 12
	16 q	16	16	110	16	C 16
	20 q	20	20	125	20	C 20
	25 q	25	25	140	25	C 25
	32 q	32	32	170	32	C 32
	40 q	40	40	200	40	C 40
h = rectangular shank 	20 h	20	12	125	20	C 12
	25 h	25	16	140	25	C 16
	32 h	32	20	170	32	C 20
	40 h	40	25	200	40	C 25
	50 h	50	32	240	50	C 32

*) Insertion depth $e \approx 0,4 \times$ thickness s of tool tip after DIN 4950 (ISO).

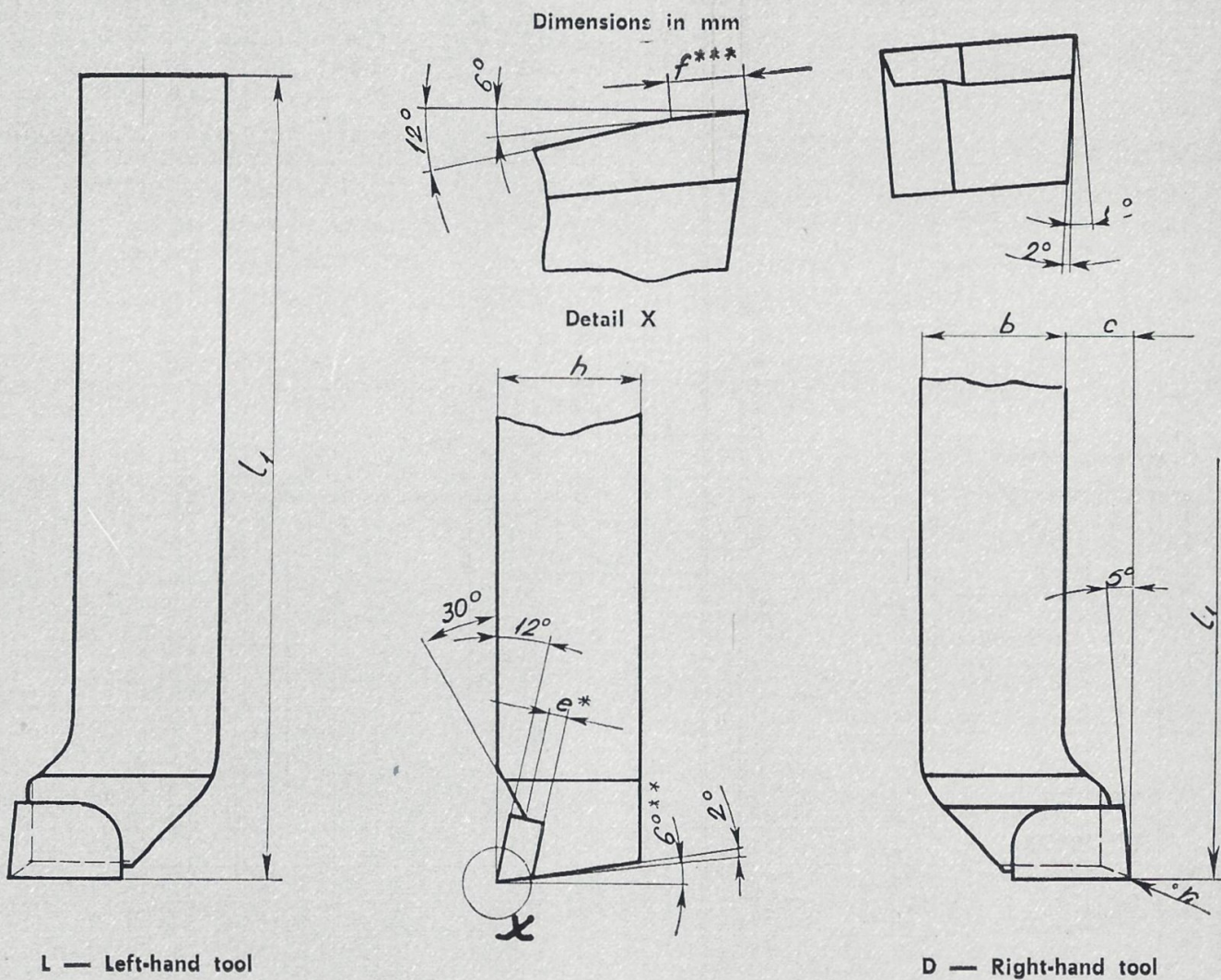
**) Clearance angle of 6° is valid for back face of tool tip. Clearance angle of facet is 1° smaller.

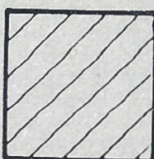
***) Width of front facet $f \approx 0,2 \times$ width of tool tip t after DIN 4950 (ISO).

FRONT TOOL VELEBIT TIPPED

DIN 4977 After ISO 5

With tools of shank section 16 h and 20 h the tool tip is inserted with its full thickness into the shank whereas with the other sections partially only.*)



Section of shank	Symbol of shank	h	b	c	l_1 +5%	r_1	Tool tip	
	16 q	16	16	8	110	0,5	A 12	B 12
	20 q	20	20	10	125	0,5	A 16	B 16
	25 q	25	25	12	140	1	A 20	B 20
	32 q	32	32	16	170	1	A 25	B 25
	40 q	40	40	20	200	1	A 32	B 32
	50 q	50	50	25	240	1,6	A 40	B 40

*) Insertion depth $e \approx 0,4 \times$ thickness s of tool tip after DIN 4950 (ISO).

***) Clearance angle of 6° is valid for back face of tool tip. Clearance angle of facet is 1° smaller.

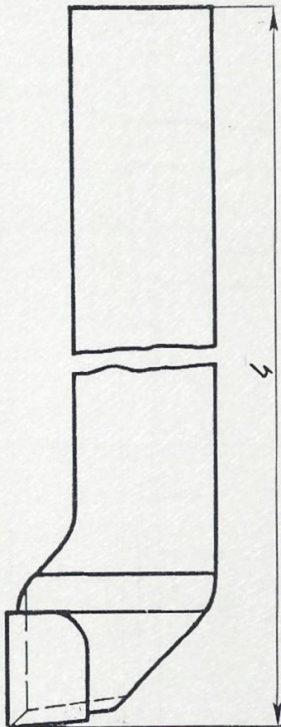
****) Width of front facet $f \approx 0,2 \times$ width of tool tip after DIN 4950 (ISO).



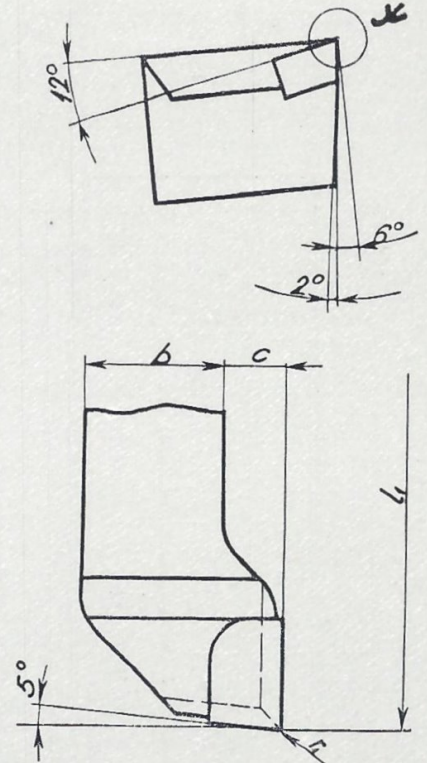
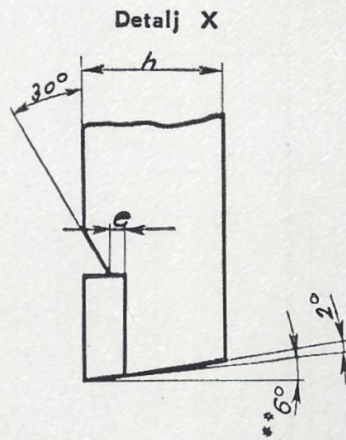
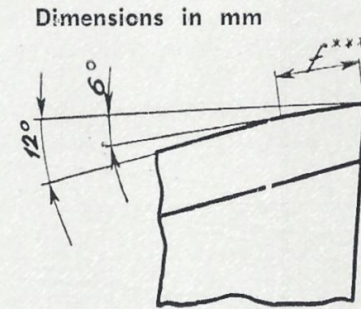
FACING TOOL VELEBIT TIPPED

DIN 4980 After ISO 6



With tools of shank section 10 q and 12 q the tool tip is inserted with its entire thickness into the shank, whereas with the other sections partially only.*)



L — left-hand cutter



D — right-hand cutter

Section of shank	Symbol of shank	h	b	c	l ₁ + 5%	r ₁	Tool tip	
							for left-hand tool	for right-hand tool
q = square shank 	10 q	10	10	4	90	0,5	B 8	A 8
	12 q	12	12	5	100	0,5	B 10	A 10
	16 q	16	16	6	110	0,5	B 12	A 12
	20 q	20	20	8	125	0,5	B 16	A 16
	25 q	25	25	10	140	1	B 20	A 20
	32 q	32	32	12	170	1	B 25	A 25
	40 q	40	40	14	200	1	B 32	A 32
	50 q	50	50	18	240	1,6	B 40	A 40
	63 q ¹⁾	63	63	22	— ¹⁾	1,6	B 50	A 50
h = rectangular shank 	20 h	20	12	6	125	0,5	B 12	A 12
	25 h	25	16	8	140	0,5	B 16	A 16
	32 h	32	20	10	170	0,5	B 20	A 20
	40 h	40	25	12	200	1	B 25	A 25
	50 h	50	32	14	250	1	B 32	A 32

*) Insertion depth $e \approx 0,4 \times$ thickness s of tool tip after DIN 4950 (ISO).

**) Clearance angle of 6° is valid for back face of tool tip. Clearance angle of facet is 1° smaller.

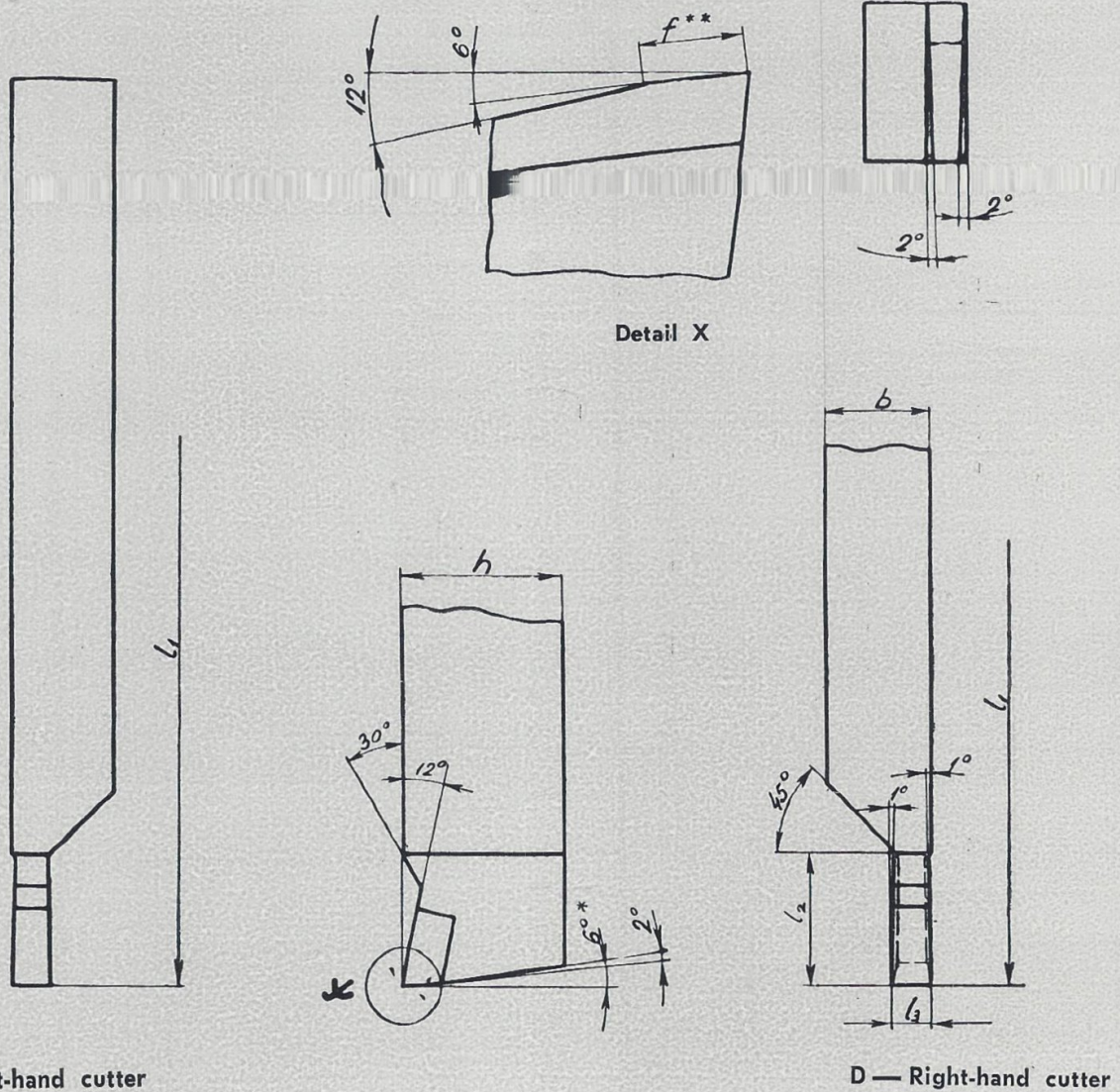
**) Width of front facet $f \approx 0,3 \times$ width t of tool tip after DIN 4950 (ISO).

1) Tools of those sizes are designed for special purposes. The given dimensions serve as guides for the design of tools. When the quoted sizes are demanded length l_1 must be given with the order.

PARTING TOOL VELEBIT TIPPED

DIN 4981 after ISO 7

Dimensions in mm



L — Left-hand cutter

D — Right-hand cutter

Section of shank	Symbol of shank	h	b	l_1 + 5%	l_2	l_3	Tool tip
<h3>h = rectangular</h3>	12 h	12	8	100	12	3	D 3
	16 h	16	10	110	14	4	D 4
	20 h	20	12	125	16	5	D 5
	25 h	25	16	140	20	6	D 6
	32 h	32	20	170	25	8	D 8
	40 h	40	25	200	32	10	D 10
	50 h	50	32	240	40	12	D 12

*) Clearance angle of 6° is valid for back face of tool tip. Clearance angle of facet is 1° smaller.
 **) Width of front facet $f \approx 0,2 \times$ width of tool tip t after DIN 4950 (ISO).

INTERNAL TOOL VELEBIT TIPPED

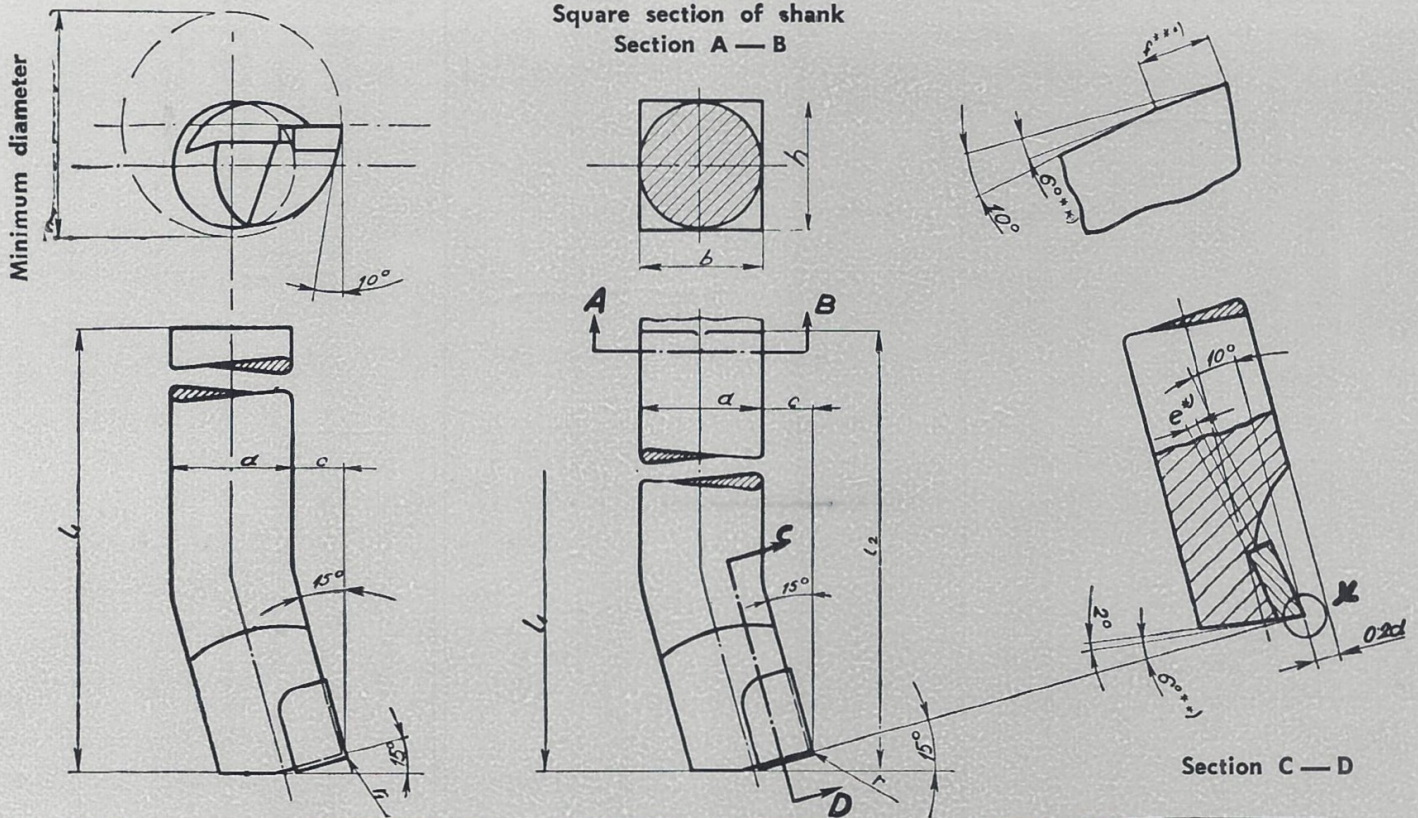
DIN 4973 after ISO 8

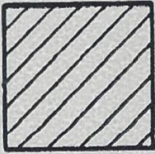
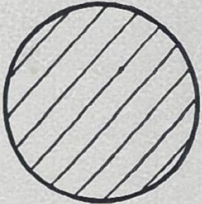
With tools of shank section 10 q and 12 q the tool tip is inserted with its entire thickness into the shank, whereas with the other sections partially only.*)

Round section of shank

Dimensions in mm

Detail X



Section of shank	Symbol of shank	h	b	d	c	l_1 +5%	l_2	r_1	Tool tip	Minimum diameter
q = square 	8 q	8	8	8	3	125	40	0,5	A 5	
	10 q	10	10	10	4	150	50	0,5	A 6	18
	12 q	12	12	12	5	180	63	0,5	A 8	21
	16 q	16	16	16	6	210	80	0,5	A 10	27
	20 q	20	20	20	8	250	100	0,5	A 12	34
	25 q	25	25	25	10	300	125	1	A 16	43
	32 q	32	32	32	12	355	160	1	A 20	52
	40 q ¹⁾	40	40	40	16	¹⁾	200	1	A 25	62
r = round 	8 r	—	—	8	3	125	—	0,5	A 5	14
	10 r	—	—	10	4	150	—	0,5	A 6	18
	12 r	—	—	12	5	180	—	0,5	A 8	21
	16 r	—	—	16	6	210	—	0,5	A 10	27
	20 r	—	—	20	8	250	—	0,5	A 12	34
	25 r	—	—	25	10	300	—	1	A 16	43
	32 r	—	—	32	12	355	—	1	A 20	52
	40 r	—	—	40	16	¹⁾	—	1	A 25	62

*) Insertion depth $e \approx 0,4 \times$ thickness s of tool tip after DIN 4950 (ISO).

**) Clearance angle of 6° is valid for back face of tool tip. Clearance angle of facet is 1° smaller.

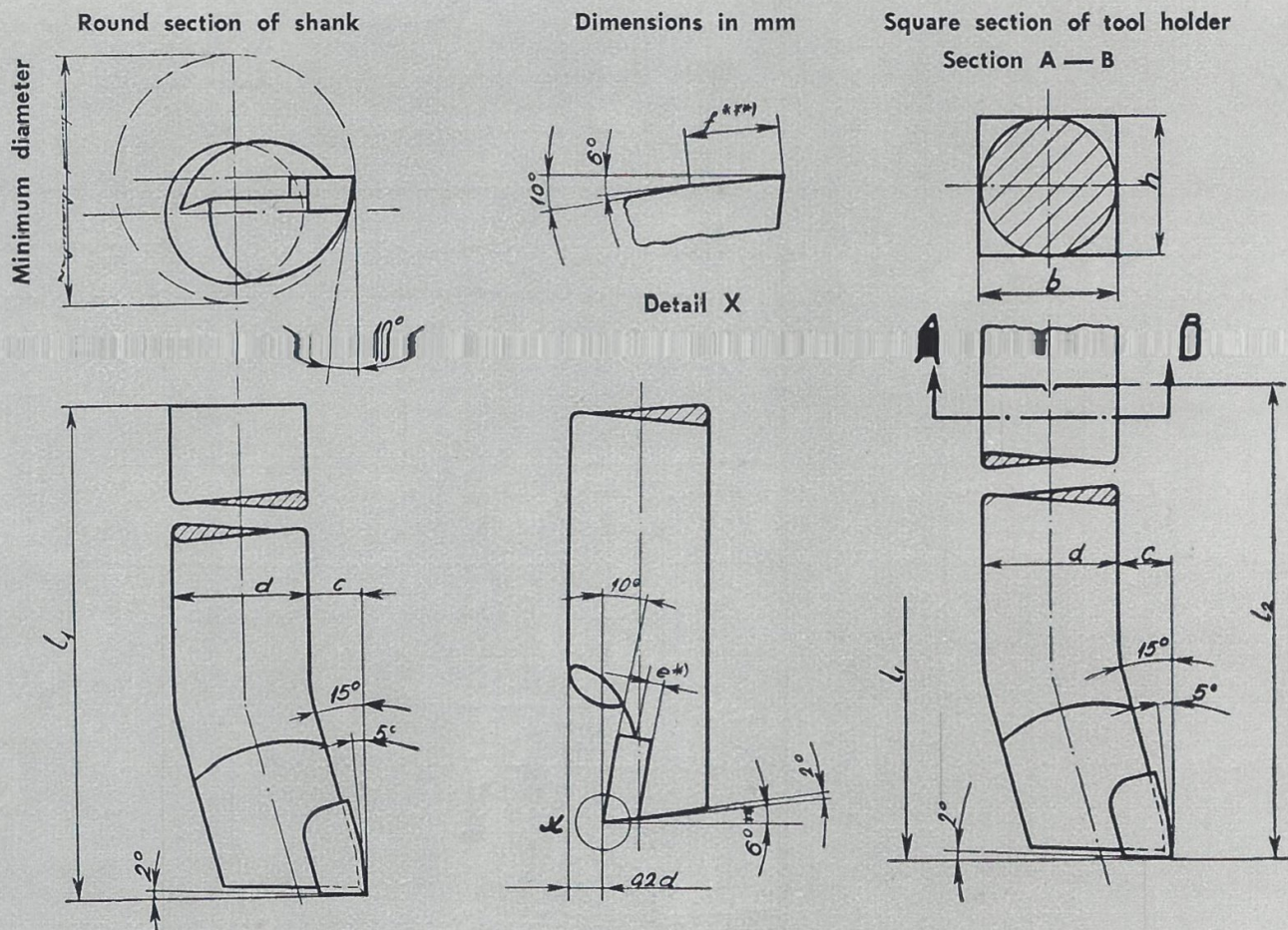
***) Width of front facet $f \approx 0,2 \times$ width t of tool tip after DIN 4950 (ISO).


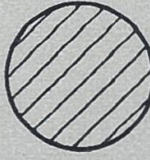
1) Tools of those sizes are designed for special purposes. The given dimensions serve as guides for the design of tools. When the quoted sizes are demanded length l_1 must be given with the order.

CRANKED INTERNAL TOOL VELEBIT TIPPED

DIN 4974 after ISO 9

With tools shank section 10 q and 12 q the tool tip is inserted with its entire thickness into the shank, whereas with the other sections partially only.*)



Section of shank	Symbol of shank	h	b	d	c	l ₁ + 5%	l ₂	r ₁ ≈	Tool tip	Minimum diameter
q = square 	8 q	8	8	8	3	125	40	0,5	A 5	14
	10 q	10	10	10	4	150	50	0,5	A 6	18
	12 q	12	12	12	5	180	63	0,5	A 8	21
	16 q	16	16	16	6	210	80	0,5	A 10	27
	20 q	20	20	20	8	250	100	0,5	A 12	34
	25 q	25	25	25	10	300	125	1	A 16	43
	32 q	32	32	32	12	355	160	1	A 20	51
40 q ¹⁾	40	40	40	16	1)	200	1	A 25	62	
r = round 	8 r	—	—	8	3	125	—	0,5	A 5	14
	10 r	—	—	10	4	150	—	0,5	A 6	18
	12 r	—	—	12	5	180	—	0,5	A 8	21
	16 r	—	—	16	6	210	—	0,5	A 10	27
	20 r	—	—	20	8	250	—	0,5	A 12	34
	25 r	—	—	25	10	300	—	1	A 16	43
	32 r	—	—	32	12	355	—	1	A 20	51
	40 r ¹⁾	—	—	40	16	1)	—	1	A 25	62

*) Insertion depth $e \approx 0,4 \times$ thickness s of tool tip after DIN 4950 (ISO).

**) Clearance angle of 6° is valid for back face of tool tip. Clearance angle of facet is 1° smaller.

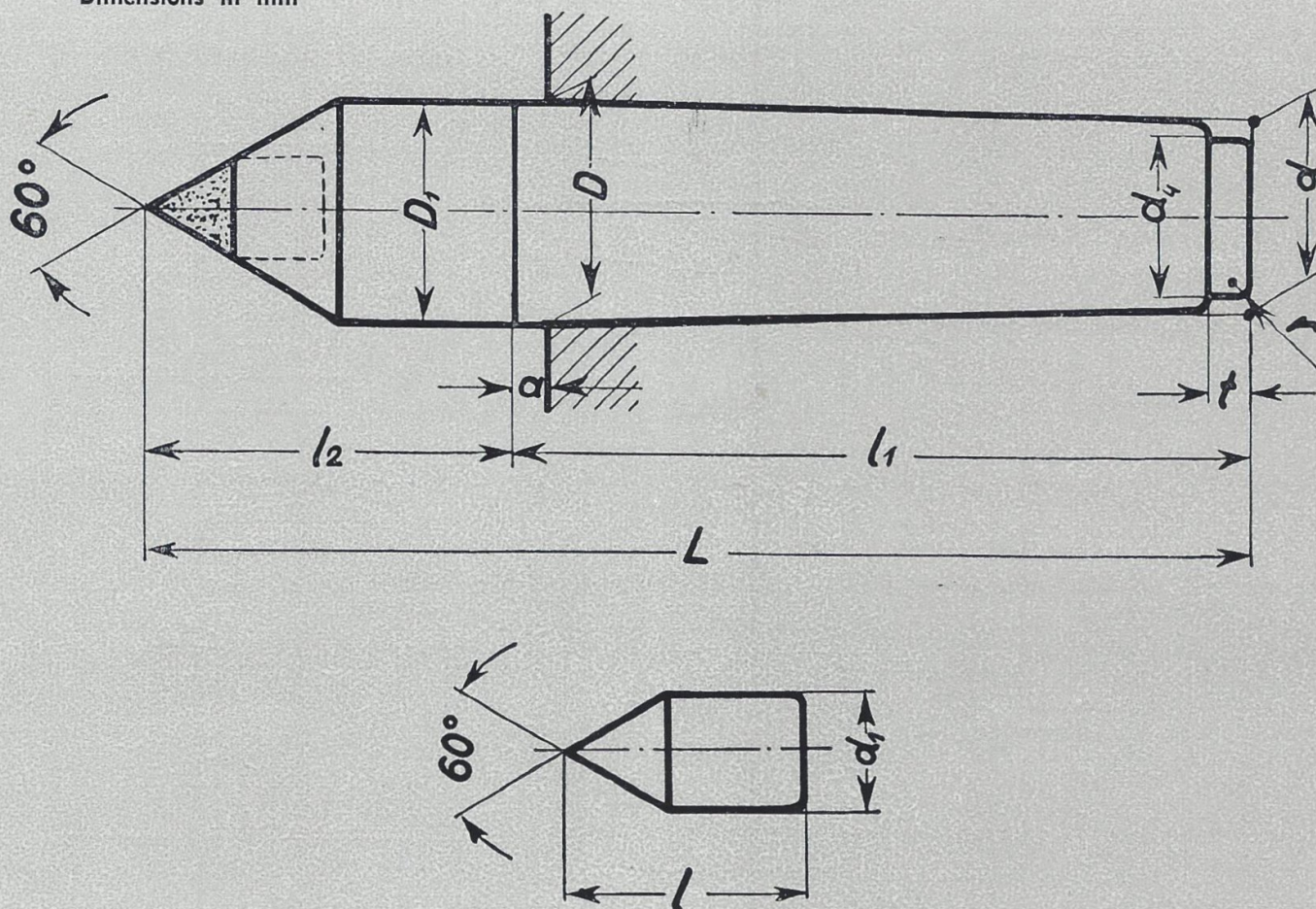
***) Width of front facet $f \approx 0,2 \times$ width t of tool tip after DIN 4950 (ISO).

1) Tools of those sizes are designed for special purposes. The given dimensions serve as guide for the design of tools. When the quoted sizes are demanded length l_1 must be given with the order.

LATHE CENTERS

with VELEBIT insertion piece
DIN 806

Dimensions in mm



C E N T E R													VELEBIT insertion piece	
Mark	Morse cone	D	D ₁	d	d ₄	L	l ₁	l ₂	t	r	Maxim. dimensions	Weight approx.	d ₁	l
													mm	mm
806.0	0	9,045	9,212	6,401	5,5	72	54	18	2,5	1	3,2	0,03	5	12
806.1	1	12,065	12,239	9,371	8	85	57,5	27,5	3	1,25	3,5	0,06	7	14
806.2	2	17,781	17,981	14,534	13	110	69	41	4	1,5	4	0,2	7	14
806.3	3	23,826	24,052	19,760	18	130	85,5	44,5	4	2	4,5	0,4	11	20
806.4	4	31,269	31,544	25,909	24	160	108,5	51,5	5	2,5	5,3	0,8	14	22
806.5	5	44,401	44,732	37,470	35	200	138	62	6	3	6,3	1,9	18	30
806.6	6	63,350	63,762	53,752	50	265	192	73	7	4	7,9	5	18	30

On buyer's demand we make centers with other angles.

State with the order :

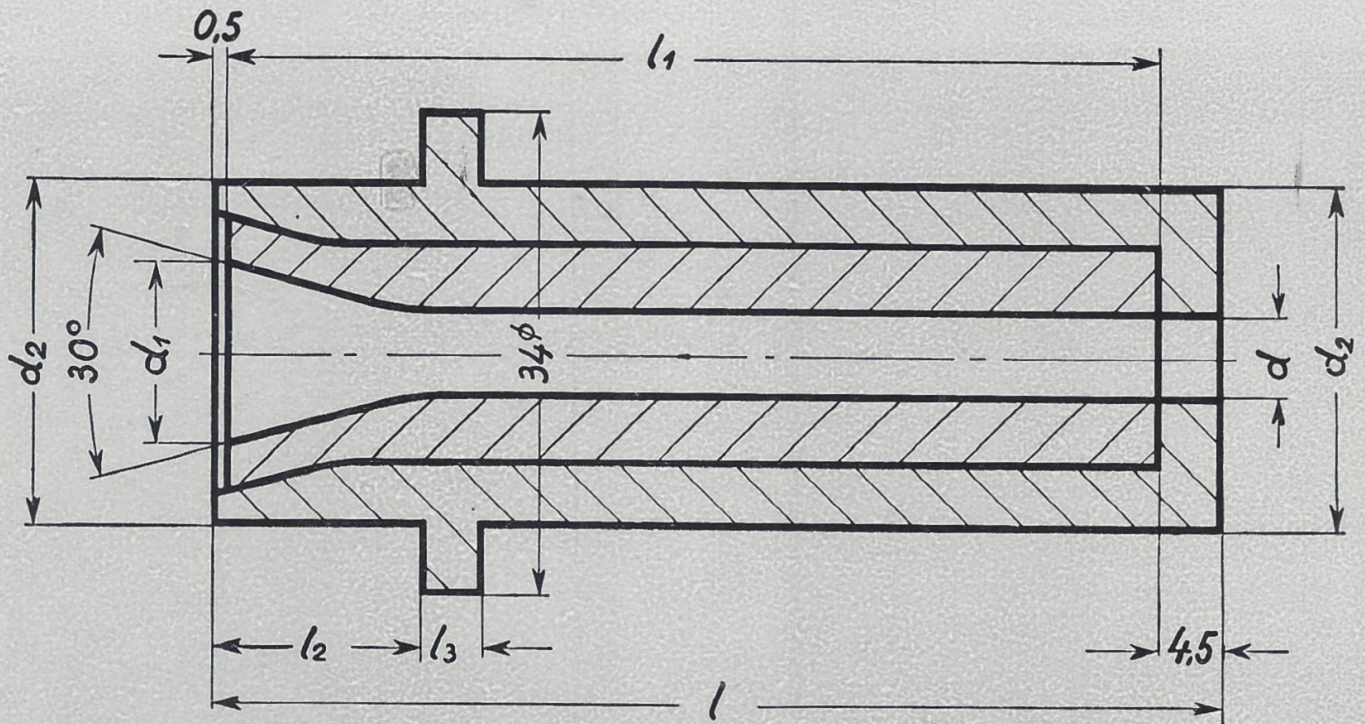
Example : 806.3

1. Mark

2. Center angle if different of 60°.

VELEBIT JET PIPE

Dimensions in mm



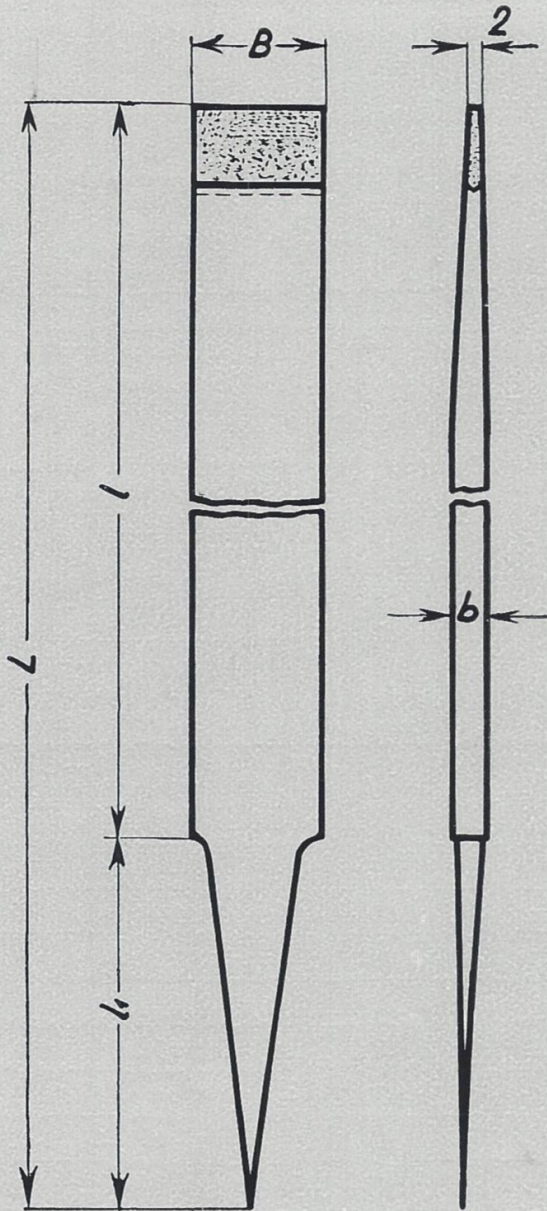
d mm	d ₁ mm	d ₂ mm	l mm	l ₁ mm	l ₂ mm	l ₃ mm
2	10	18	45	40	15	4
3	11	18	45	40	15	4
4	12	20	45	40	15	4
5	13	20	55	50	15	4
6	14	22	65	60	15	4
7	15	24	75	70	15	4
8	16	24	85	80	15	7
9	17	24	95	90	15	7
10	18	26	100	95	15	7
10	18	26	105	100	15	7
11	19	26	100	95	25	7
11	19	26	115	110	25	7
12	20	30	100	95	25	7
12	20	30	125	120	25	7
13	21	30	100	95	25	7
13	21	30	135	130	25	7
14	22	30	100	95	25	7
14	22	30	145	140	25	7

State diameter d with the order as well as length l.

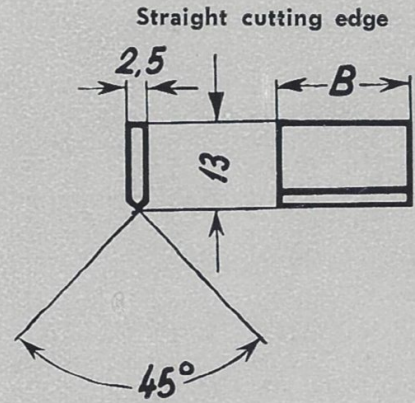
FLAT HAND SCRAPER

with VELEBIT tool tip

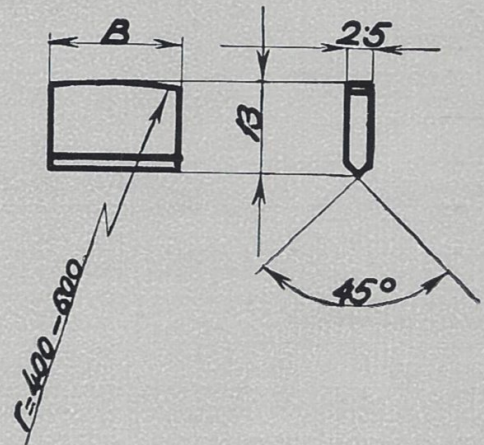
Shape of scraper



Dimensions in mm



Rounded cutting edge



Width of scraper approx. B	Length			Thickness of handle b approx.	Weight of tool tip approx. g.	Total weight of scraper approx. kg
	L	l	li			
10	200	150	50	4	5	0,06
16	250	195	55	4	8	0,13
20	300	240	60	4	10	0,19
25	325	255	70	4	12	0,26
30	350	270	80	5	15	0,42

State with the order: 1. Width B of scraper
2. Shape of cutting edge (straight or round).

In addition to the products mentioned in this catalogue we manufacture special tool tips for geological purposes, soil testing, and works connected with mining.

With these products deals our special catalogue.



