DICK

Traditionsmarke der Profis

THE FILE

ON THE PRODUCTION AND USE OF AN INDISPENSABLE TOOL

COMPANY BUILDING IN DEIZISAU SINCE 1997

HISTORICAL COMPANY BUILDING IN ESSLINGEN

TRADITIONALLY BETTER SINCE 1778

Friedr. Dick was founded in Esslingen am Neckar in 1778 and even today, more than 240 years later, the company is still a family-owned company. Many years of experience in the field of file production combined with modern and efficient work processes and high-performance partners guarantee optimum customer-oriented service.

With our wide range of top quality files, we are the right partner for all industrial, craft and hobby applications.

PRECISION IN PERFECTION

A company with a tradition that goes back more than 240 years can only exist so long, if it can guarantee customer satisfaction by means of quality and service. The F. Dick brand stands for quality files with optimum cutting performance and long service life.

THE ADVANTAGES OF OUR FILES

THE ADVANTAGES OF OUR PRECISION FILES

F.DICK. Precision Files are made and controlled to our traditional work standards and German Scale of Cuts. The carton with detailed label assures safe storage and easy repeat orders. Our high quality files are single packed in a clear cover. Therefore, they are well protected and you are able to remove them without difficulties. Due to the labelling with barcode and item number, loose files can also be easily identified and reordered.

PRECISION FILES STAND OUT THANKS TO:

- Precise and careful finish
- Long durability
- Perfect cuts
- Taper profiles
- Sharp edges
- Slight convexity
- A multitude of profiles, designs and cutting partitions
- Ideal hardness of 65-66 HRC
- Single packing with barcode labelling and item descriptions
- Premium material quality

THE ADVANTAGES OF OUR ENGINEER´S FILES

In our range of engineers' files you will find files and rasps as well as key and saw files for general and rough file workings. These favourable alternatives to precision files are manufactured according to DIN and available in the most popular cuts 1, 2 and 3. Particularly advised for steel, iron, nonferrous metals in industry, trade and hobby. The files will be delivered single packed in carton.

SELF SERVICE PACKING

FOREWORD

In 1925 Dr. Otto Dick wrote the book ‘Die Feile und ihre Entwicklungsgeschichte’, a standard work compiling the knowledge of that time on the file and its manufacture.

Since that time, many aspects have changed in the production and use of files and rasps. We only need to consider the structural changes in our economy, e.g. in agriculture, horses have been replaced by tractors and cobblers by machines such that the demand for hoof rasps and shoemaker rasps has decreased. Further examples are the revolution which has taken place in the watch and clockmaking industry and also the fact that milling, grinding and other highly developed cutting processes can be employed in many cases more advantageously than filing which admittedly is often wearisome.

On the other hand, new scopes and application has been developed. The file is still also the most suitable of all possible tools for training in metalwork and other associated applications since the trainee using the file must come to terms with the material and also learns what precision really means.

Despite all the structural changes, the significance of the file, which is produced in several thousand different shapes, sizes and types of cut in order to satisfy numerous differing requirements, today remains undeniable.

The intention of this book is to provide useful information on this seemingly everyday yet versatile and often specialized tool.

CONTENT

INTRODUCTION

The file is considered to be one of the oldest tools around and has already been known to the Romans and Celts, and also to the ancient Greeks and Egyptians.

By 800-700 BC iron took the place of bronze as the material for making implements and tools. From that time onwards axes, knives, swords and also files were made of iron. It may be assumed that starting with the 11th century files were made of steel and could be hardened. The professional production of files by craftsmen started in the 15th century at Nuremberg.

Leonardo da Vinci designed the first file cutting machine around the year 1503. The design of a French file cutting machine followed in 1627. From then on, any number of such machines were designed and manufactured with more or less success in France, England, America, Sweden and Switzerland. The first file cutting machine installed in Germany was built in Switzerland in 1880 and operated by Friedr. Dick GmbH in Esslingen in 1881.

In spite of the continuously progressing mechanization of surface finishing in the range of chip-removing operations by turning, milling, planning, grinding up to electrosparking and electrolytic erosion, the file has remained an indispensable manual and machine tool up to the present time and cannot be dispensed with in the forseeable future.

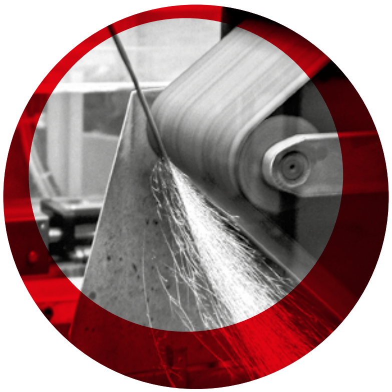
PRESENT RANGES OF APPLICATION ARE: tool, pattern and mould making, the instruction of trainees and apprentices, repairs, cleaning and deburring jobs, the electrical industry, precision mechanics and the jewellery and ornaments industry, sharpening of saws and other tools, the do-it-yourself sector, as well as many fields of application in industry and trade which require special version of files.

CLASSIFICATION OF FILES WITHIN RANGE OF TOOLS

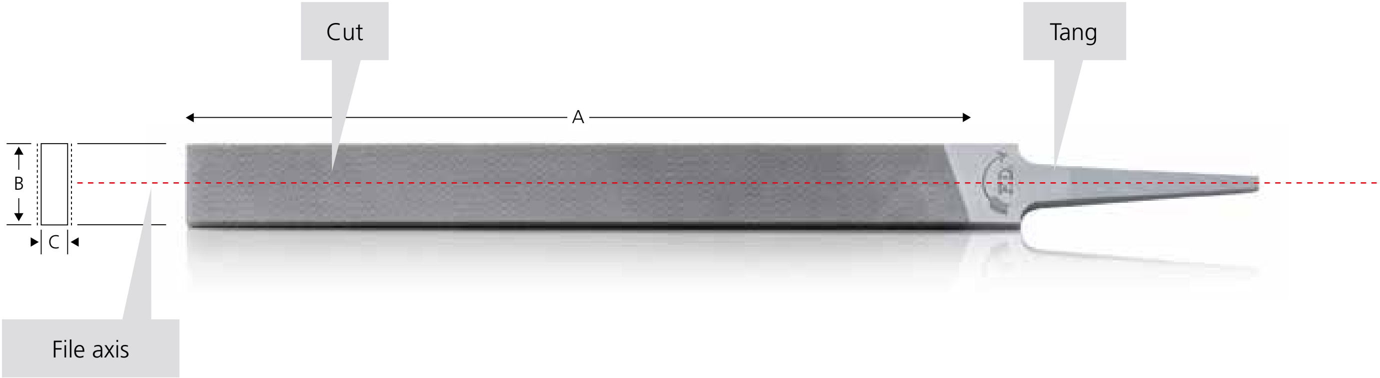
The file is a multi-edged, chip removing tool. When a file is operated, manually or on a machine in a straight cutting line, the chipping process is similar to broaching. When used as a rotating machine tool (e.g. as a file disc or a rotary file) the chipping operation is similar to milling.

The rules applying to chipping operations by means of turning tools, planning tools and the teeth of a milling cutter apply in principle also to the teeth of files, with the exception of milled teeth. The individual teeth on a file, their shape and dimension, cannot be produced as accurately as the cutting edges of conventional machine tools.

These disadvantages is the result of the cutting methods used for making files. On the other hand, the same methods provide the advantage of manufacturing a cutting tool having an extremely fine tooth spacing coupled with excellent uniformity. 100 teeth and more per cm of a file´s length are well within the range of possibilities.



DESIGN OF A FILE



A = Cut or total length, depending on file type . B = Width of the flat side . C = Thickness of the narrow side

Normally the measurements of lengths >>A<< are the cut lengths. In some cases length A is the total length of the file, e.g. the needle file. The sections are to be measured at the widest point of the uncut file piece. The file body is one-sided or multi-sided and usually ends in the file tang at one end. Traditionally the file tang is unhardened and is tapered down to a pointed end where a file handle can be attached that is usually made of wood or plastic. For more information about file production, refer to the section 'Production of files and rasps'. The term 'file axis' is the general middle line of a file.

4.0

THE CUT

4.1 TYPES OF CUT

Single-cut file, cross-cut or double-cut file, rasp with rasp cut, milled file and **file with diamond coating in various grains**.

SINGLE-CUT FILE

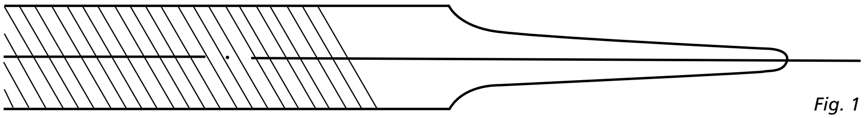


Fig. 1

CROSS-CUT FILE

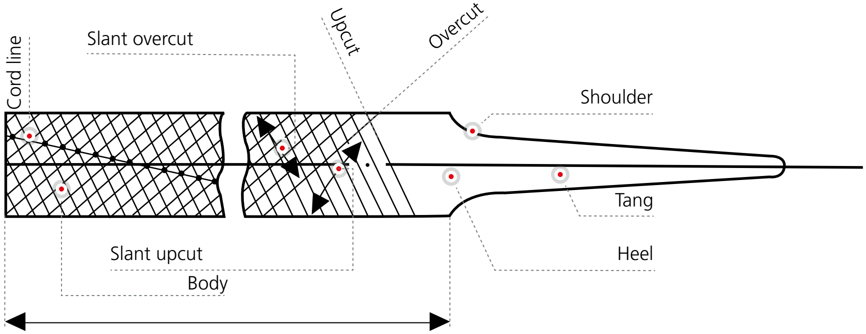
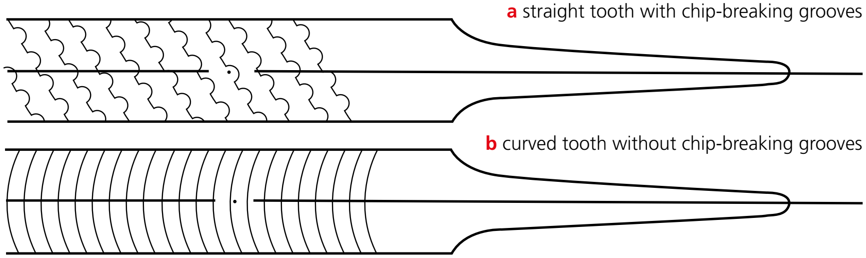


Fig. 2

MILLED TOOTH FILES

a straight tooth with chip-breaking grooves



b curved tooth without chip-breaking grooves

Fig. 3 a and b

Rasps are provided with individual teeth in the shape of dots (Fig. 4). They are used for processing wood, leather, cork, horn, rubber, plastics and stone.

RASPS

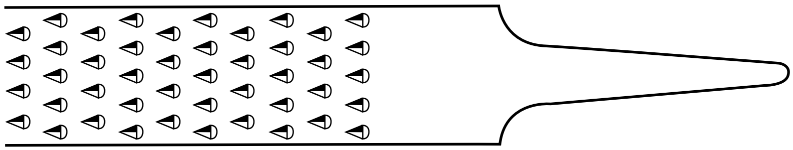


Fig. 4

4.2 CUT NUMBERS WITHIN THE TYPES OF CUT:

FOR PRECISION FILES		
	Cut no. 00	↑
	Cut no. 0	Coarse
Bastard/coarse	Cut no. 1	
Second cut/medium	Cut no. 2	
Smooth/fine	Cut no. 3	
	Cut no. 4	
	Cut no. 5	
	Cut no. 6	Fine
	Cut no. 8	↓

FOR ENGENEERS´ FILES	
Bastard/coarse	Cut no. 1
Second cut/medium	Cut no. 2
Smooth/fine	Cut no. 3

FOR MILLED FILES	
Coarse	Toothing 1
Medium	Toothing 2
Fine	Toothing 3

FOR DIAMOND FILES		
Grains	D91	↑ Fine
Grains	D126	
Grains	D181	↓ Coarse

! Named grains for diamond files are the most common ones. Further grains are available.

4.3 COUNTING METHODS FOR GERMAN CUT AND SWISS CUT

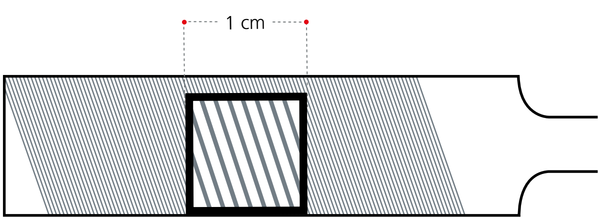


Fig. 5 DIN and F. Dick cut counting method

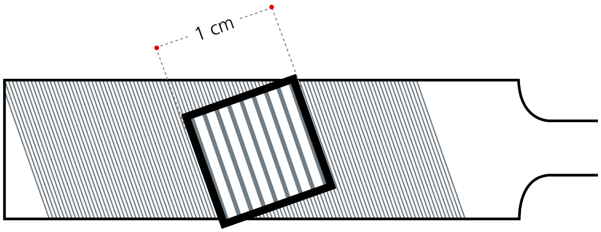


Fig. 6 Swiss cut counting method

The cut of a file can be classified in accordance with the German Scale of Cut or the Swiss Scale of Cut. The difference lies in the way the number of teeth of a file is counted. According to DIN8349 / ISO234/2 1982E the cut is measured and counted parallel to the file axis which leads to the number of cuts according to the German Scale of Cut (Fig. 5). The Swiss is measured and counted at a right angle to the cut (Fig. 6).

4.4 CUT TABLE:

The following is a general overview of the conversion from German cuts to Swiss cuts. Please note that the following tables only contain approximate values.

PRECISION FILES 4"/100 MM - 8"/ 200 MM								
Swiss cut	00	0	1	2	3	4	5	6
Number of teeth per cm	16	20	25	31	38	46	56	68
= German cut								
for files 4"/ 100 mm	1		2	3		4	5	6
for files 5"/ 125 mm	1	2		3		4	5	6
for files 6"/ 150 mm	1	2	3		4	5	6	8
for files 8"/ 200 mm	1	2	3	4		5	6	8

PRECISION FILES 10"/250 MM - 12"/ 300 MM						
Swiss cut	00	0	1	2	3	4
Number of teeth per cm	12	16	20	25	31	38
= German cut						
for files 10"/ 250 mm	1	2	3		4	5
for files 12"/ 300 mm	2		3	4	5	0

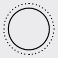
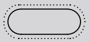
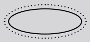
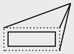
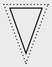
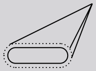
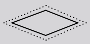
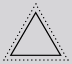
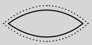
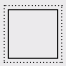
ESCAPEMENT FILES									
Swiss cut	00	0	1	2	3	4	5	6	8
Number of teeth per cm	20	25	31	38	46	56	68	84	116
= German cut				2		5			8

RIFFLER FILES 150 MM AND 170 MM			
Swiss cut	0	2	4
Number of teeth per cm	25	38	56
= German cut	1	2	4

NEEDLE FILES								
Swiss cut	00	0	1	2	3	4	5	6
Number of cuts/teeth per cm	20	25	31	38	46	56	68	84
= German cut	00	1	2	3	4	5		

RIFFLER FILES 180 MM AND 300 MM			
Swiss cut	00	0	2
Number of teeth per cm	12	16	25
= German cut		1	2

CROSS-SECTIONS

	HAND		ROUND
	HAND WITH ROUND EDGES		OVAL
	WARDING		KNIFE
	CROCHET		SLITTING
	HALFROUND		BARRETTE
	THREESQUARE		CROSSING
	SQUARE		

FILES AS MANUAL AND MACHINE TOOLS

Manual tools are manually operated files and rasps comprising a file body and tang, with their cross sections extending along the entire length, parallel or tapered in direction of point. The tang serves to hold a handle made of wood or plastics.

MACHINE TOOLS INCLUDE:

Reciprocating files, with parallel cross-sections or tapered toward point (Fig. 7). They are clamped into pneumatic and electric tools (drills, shavers, filing machines, etc.) and are used to deburring and removing of material.

LINE FILES/COMPRESSED AIR FILES

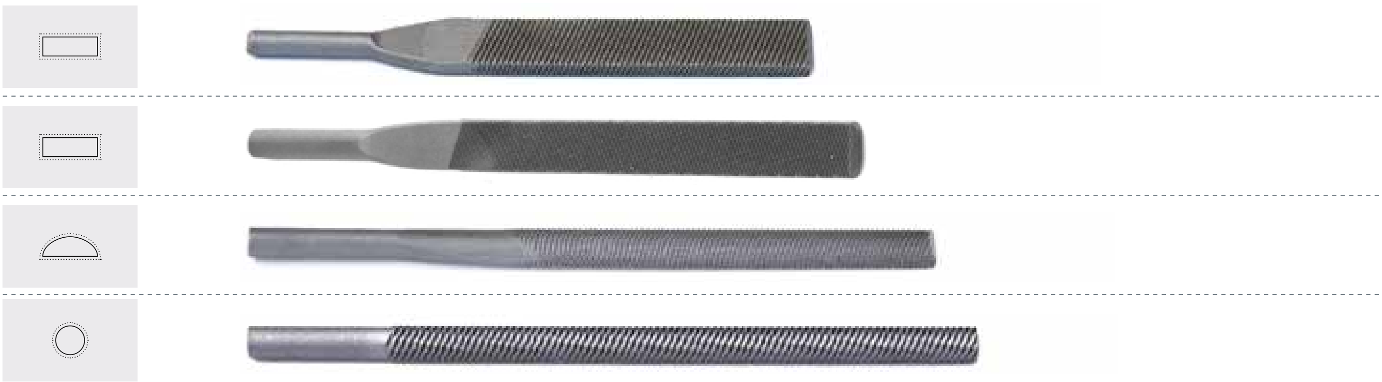


Fig. 7

Rotary file discs, milling discs and rasp discs (Fig. 8), the latter are no longer produced today. The file and milling discs are manufactured up to diameters of approx. 300 mm for use on special filing machines (Fig. 9), but also for clamping on lathes (turning machines) and milling machines.

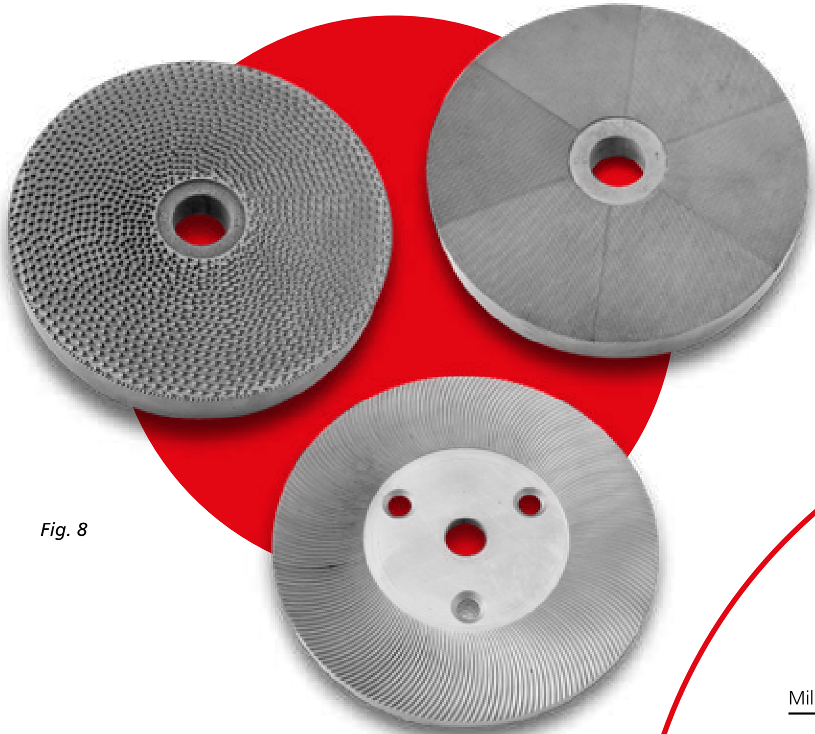


Fig. 8

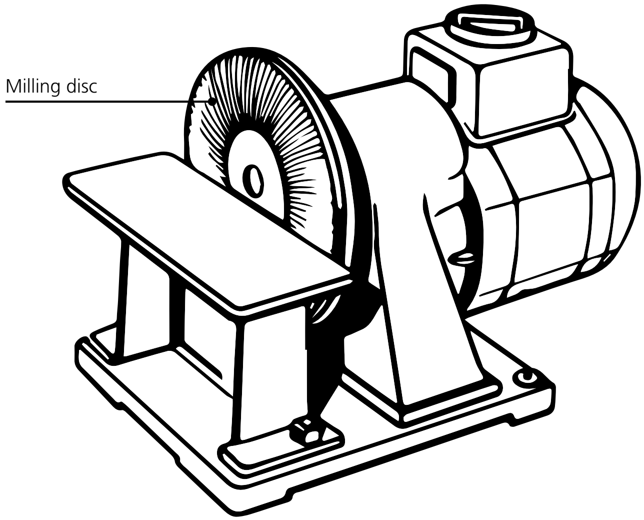


Fig. 9

ENGINEERS` FILES AND PRECISION FILES

ENGINEER`S FILES (Fig. 10) include files and rasps moved manually for general requirements. Dimensions, cross-section forms, cut data and technical delivery conditions are defined in the German norms DIN 7261-7264, DIN 7283-7285 and DIN 8349. In addition to chisel-cut-cross-cut files the term engineer files also covers saw files (sharpening files), rasps, milled files and key files.

Fig. 10

PRECISION FILES (Fig. 11) are files and rasps for precision work. They are above all used for refinishing and fine finishing (smoothing) coarsely pre-machined surfaces. They are not standardized. With regard to cross section, shape and cut are similar to engineer files. Essential differences are:

They are made of a higher grade steel, with special attention paid to cut and shape, slim and smooth taper toward point, thinly tapered points and sharp edges to the extent possible.

Precision files are generally manufactured up to and including 300 mm length. If required, larger files can be supplied as precision files and files with very fine cuts, that is, with a larger number of teeth per cm.

Precision files also include files for precision jobs, above all needle files (Fig. 12), rifflers (Fig. 13) and escapement files (Fig. 14) used for tool making, precision mechanics and the jewellery and ornaments industry.

Fig. 11

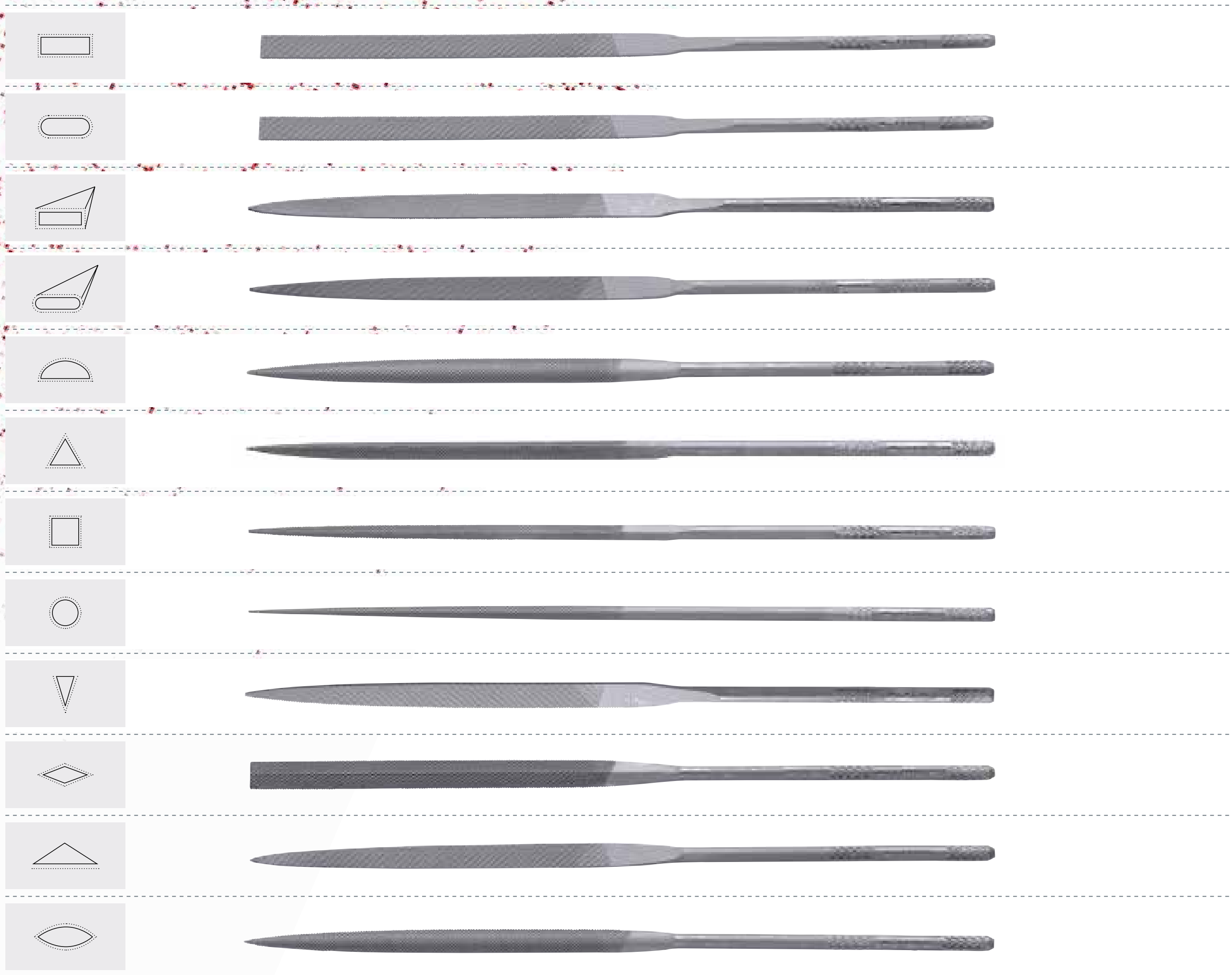


Fig. 12

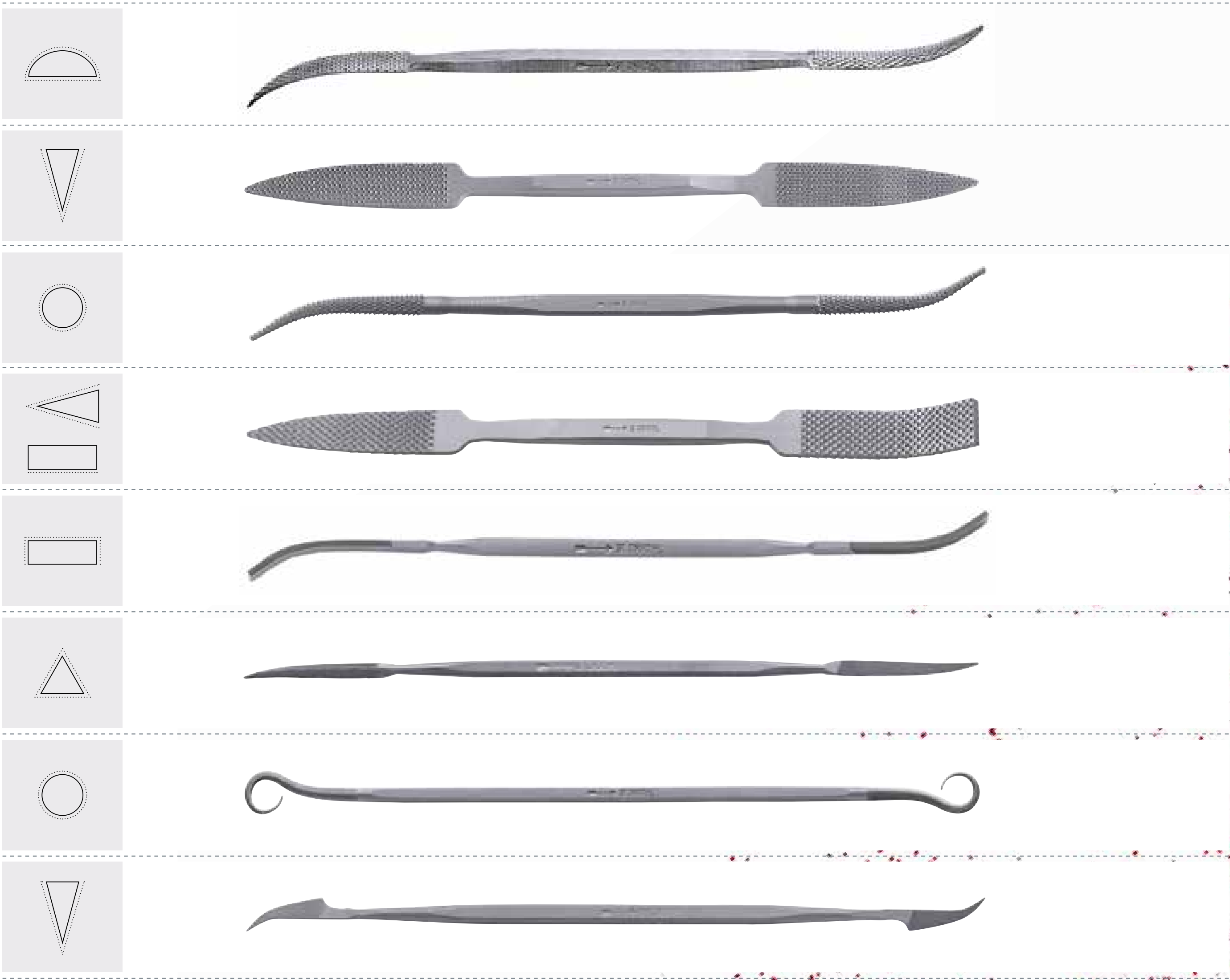


Fig. 13

ESCAPEMENT FILES

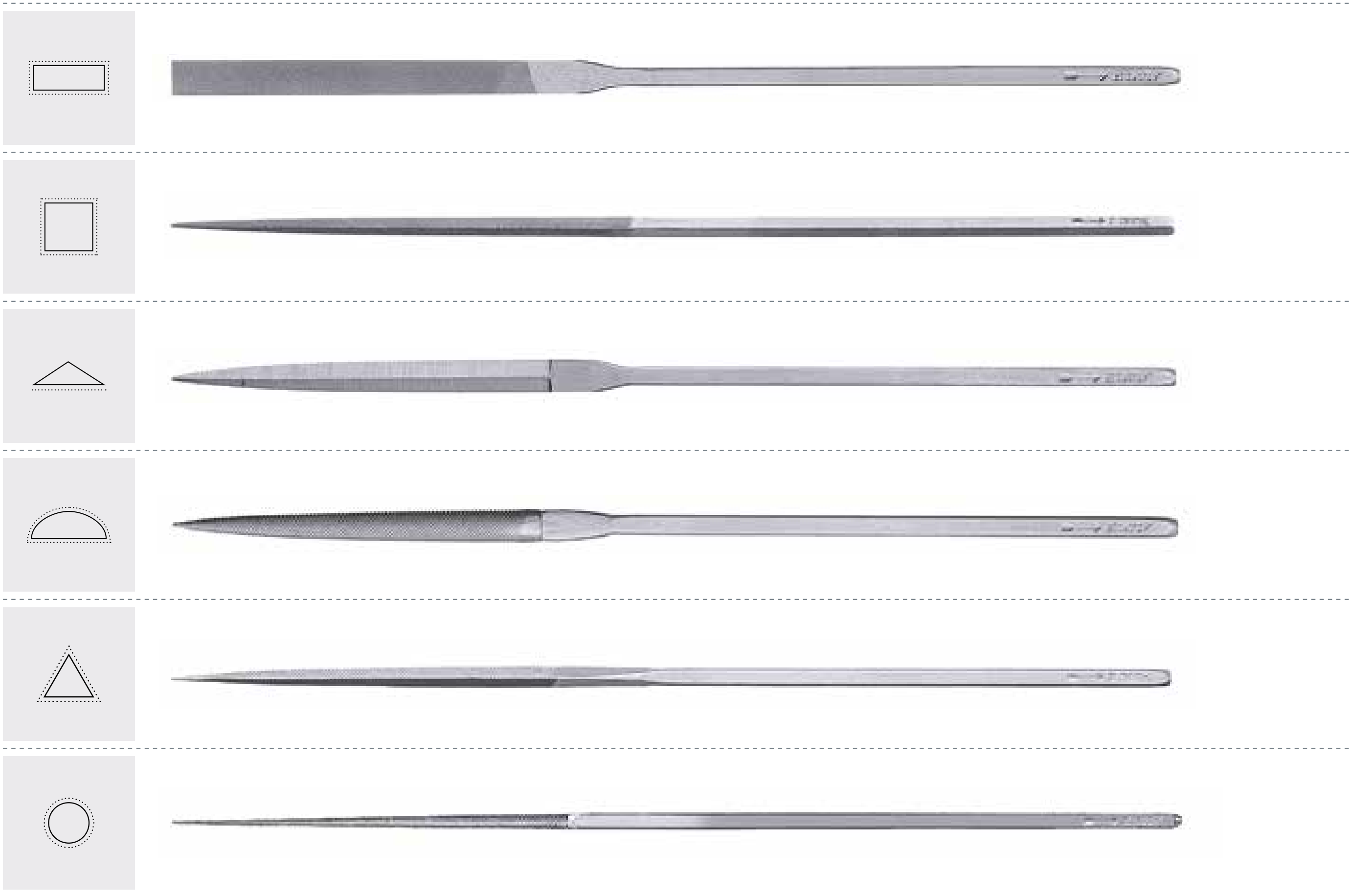


Fig. 14

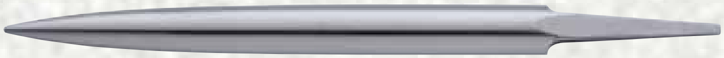
PRODUCTION OF FILES AND RASPS

8.1 FROM A BLANK TO THE FILE:

1 BLANK

2 FORGED BLANK

3 GROUND BLANK



4 OVERCUT

5 UPCUT AND HARDENED

6 SANDBLASTED AND CORROSION PROTECTION

7 MARKING AND QUALITY CONTROL

8.2 PRODUCTION OF BLANKS:

The material for making files and rasps comprises predominately tool steel types of the following compositions:

	Percent by weight					
	C	**P+S max.**	**Cr**	**W**	**Raw material numbers**	**Hardness in HRC (rounded)**
Enginneer files	1.2 to 1.3	0.07	–	–	1.1663	62 - 64
Precision files	1.4 to 1.6	0.05	0.5 to 0.7	–	1.2008	63 - 67
Sharpening files	1.25 to 1.35	0.03	0.5 to 0.7	–		
Rasps	0.35 to 0.45	0.07	–	–	1.1730/1.1740/1.175-C45/ C60/ C75	57 - 61

The file material is obtained in the shape of steel bars, which are usually already rolled to the cross sections of the files to be made thereof.

The individual blanks are cut off from these bars and are shaped cold or warm by punching, forging, rolling or pressing and are then ground as a preparation for application of cuts.

Apart from a few exceptions, the final shaping of the file body must be completed prior to application of cuts. Perfect cutting requires annealed file bodies and a surface absolutely free of de-carbonisation as well as absolute flatness in transverse direction, unless the surfaces are curved such as those for round and half-round files.

8.3 CUTS

One of the most important job sequences in the making of files is the cutting. The following cutting methods are known: chisel-cut, etching, milling, rolling and pressing or stamping.

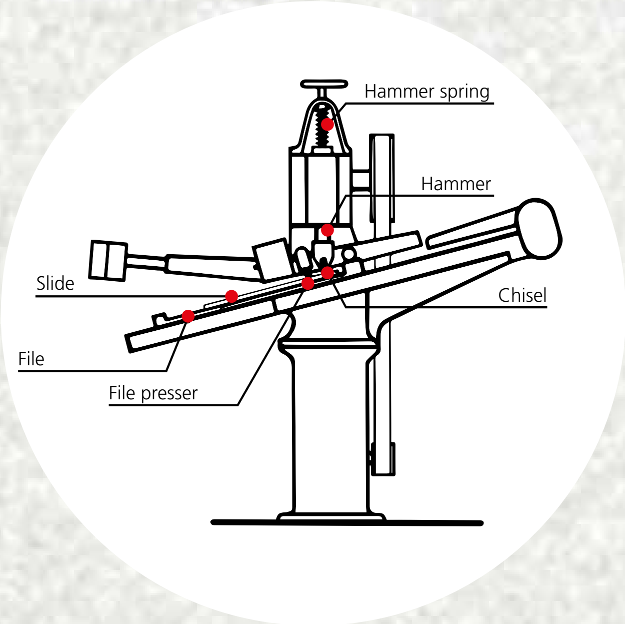
The first three are predominantly applied. But the most significant is the chisel-cut, the oldest, but also the most common of the methods named.

8.4 CHISEL-CUTTING

The cut is produced by the chisel. Cut is the name for all the teeth of a file as well as the individual tooth. The name “cut” applies also to the file teeth produced by other methods than the use of a chisel.

Nowadays, the manual application of a chisel is extremely rare. It is used for files and rasps with complicated special shapes where small quantities are required, provided the high costs resulting from manual chisel-cuts can be tolerated. Economical production is possible on file cutting machine only.

Description of cutting operation on file cutting machine (Fig. 15): During the cutting operation, the file to be cut is located on a horizontally or slightly horizontally tilted slide and is continuously moved forward in the direction of its lower end is moving up and down. During each downstroke the chisel cuts into the blank and raises a tooth on the file blank. The hammer operates vertically or almost vertically. The angle in relation to the feed of slide is 100° to 110°.



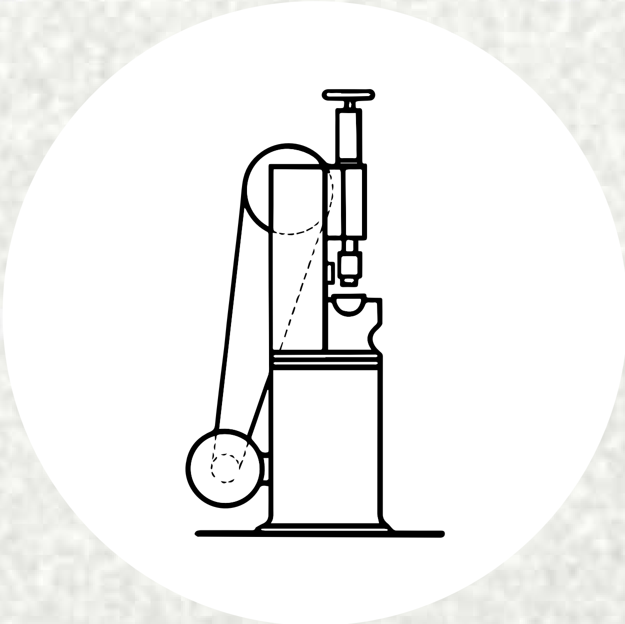


Fig. 15

The hammer is raised by means of a cam disc which carries on its circumference 1 to 4 cams of similar geometric shape. The hammer is moved downwards by the spring force each time the hammer is released by one of the cams.

The forward feed of the slide depends on the speed of the drive shaft on which the cam disc is located, that is, in dependence of the number of impacts per time unit: The dimension of the slide feed per downward stroke of chisel, or the pitch for subdivision of the cut, is set by means of change gears, so that the file is given the specified number of cuts per cm.

At the present time, the sequence of cuts on file cutting machine and also when cutting a file manually is started at file point in direction of tang.

Depending on size of the file cutting machine and number of cuts per cm the total number of cuts per minute can range between 500 and 4000.

During the cutting operation, the file should rest flat on machine slide by the pressure of a presser, which presses the file tightly against its support while simultaneously aligning the file surface in relation to the chisel. For aligning, the machine slide is designed in the shape of a semi-cylinder.

When cutting the file side which is opposite the side cut first, a support of soft metal or plastic material is required so that the cutting edges of the already cut side are not damaged.

8.5 CUTTING A FILE TOOTH

To cut the individual tooth the wedge-shaped cutting edge of the chisel should enter the surface of the blank suddenly and diagonally. A portion of the file metal will be displaced by the wedged surfaces behind the chisel edge at both sides – but more at the front – and raise the metal above the surface, shaping it into a tooth profile (Fig. 16).

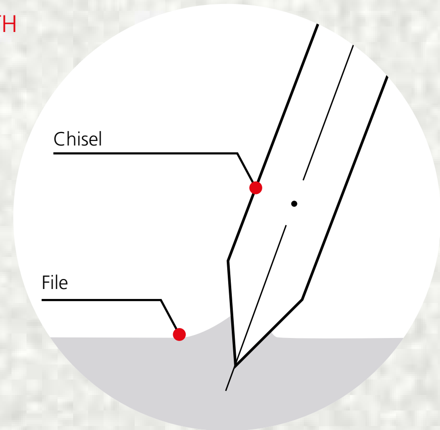
The chisel comes to a stop when the kinetic energy provided by the file cutting machine is used up by the form-changing job and by the friction at the wedge-type surfaces of the chisel edge. The required kinetic energy of the chisel is attained by pertinent adjustment of the hammer springs and the stroking height of hammer on file cutting machine.

The result of correct adjustment is a tooth with a sharp edge, where the height of the raised portion amounts to approx. 40 to 50% of the total depth of tooth.

Height of rise, depth of tooth and angle of tooth are, however, not only influenced by the strength of the impact but also by the chisel angles, the rounding of the chisel edge, the surface roughness of the chisel, the annealing strength of the file material, the surface condition of the file body, the cutting speed (number of cuts per time unit in relation to pitch) and many other factors. Later on, there is still another change of tooth profile by the unavoidable warping caused by hardening, and additional slight change by sandblasting.

This large number of functional relations shows that the shape of the file tooth cannot be made as accurately as desired, as is readily achieved with other tool cutting edges by means of milling and grinding.

FORMATION OF TOOTH



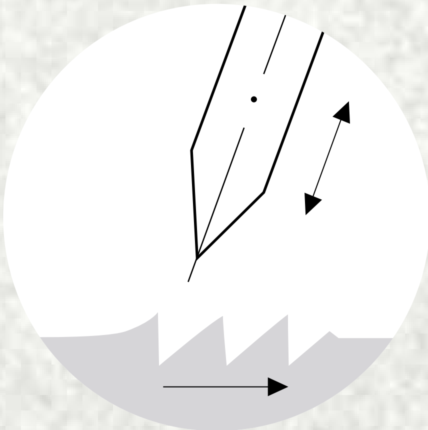


Fig. 16

8.6 RASP CUTS

A specialty in range of cutting is the cutting of rasps. The rasp teeth are cut in the shape of dots individually or simultaneously in complete cross rows. Complete cross rows can be simultaneously cut on rasp cutting machine only. Manual cutting permits individual cuts only. The cutting tool is a chisel ground to the required shape.

A look at the operation of the equipment used for forming a tooth on rasp cutting machines shows a rough subdivision into two groups. In the one group, cutting proceeds similar to a file cutting machine. The tooth depth is determined by the kinetic energy of the chisel about to enter the surface of the rasp blank.

In the second group the chisel enters the rasp material not by means of a sudden blow, but under the influence of the hammer with chisel holder and chisel driven by an eccentric shaft similar to an eccentric press.

The penetrating depth in this case is set by adjusting the height of the hammer. Instead of being rigid, the chisel holder swivels on hammer and thereby provides a digging effect during penetration of chisel which supports the raising of the rasp tooth.

Rasps are cut in direction of point starting at tang end.

8.7 ETCHING

Even though the layman may be acquainted with the term "file cutting" (by chisel) at least by hearsay, the term of "etching" is not so well known to technical personnel engaged in other fields. But next to file cutting the etching of a file tooth is a relatively often applied method of providing a file with teeth. It is used above all wherever etching is less costly than cutting and where the resulting cut (tooth) is not subject to extremes when the file is used. This applies particularly to some of the smaller files.

But etching is also taken into consideration where the surfaces receiving the teeth are round or curved and where etching is therefore more simplified and more favorable than file cutting by means of a chisel, for example crossing files.

Etching a curved or rounded (convex) surface will simultaneously provide a better rounded shape than polygon-like cutting with a chisel.

In some cases, difficulties encountered with chisel-cutting large files may also recommend switching to etching, e.g. for the very coarse cut on half-round back of soft metal files.

Etching can be done manually as well as on a machine. The etching tool is the so-called etching file, a hardened prismatic bar, e.g. with threesquare cross section and a special chisel-cut on its heavily rounded edges.

The etching file is guided several times back and forth across the file about to be provided with teeth at the required pressure, so that -in simplified terms -a negative pattern of the etching file is engraved into the surface of the file about to be completed. Actually there is not a precise negative shape, but the special design of the etching file and the special guiding method applied to the etching file result in a sharply raised tooth cutting edge on the file in progress. The resulting tooth shape will be very similar to that of a chisel-cut tooth.

8.8 MILLING, ROLLING AND PRESSING (OR STAMPING)

These production methods are not just characteristic for the production of a file cut, they are also applied and known in other ranges of the metalworking industry. For this reason a short reference will be sufficient. Milling is applied particularly to very coarse teeth as follows:

- Milling of individual teeth
- Milling of several teeth simultaneously by means of a cylindrical milling cutter
- Milling by means of a hob (circular arc method)

Rolling and pressing for shaping teeth are rare. These methods are suitable only for making overcuts since this type of forming will not provide sharp cutting edges.

8.9 HARDENING AND STRAIGHTENING

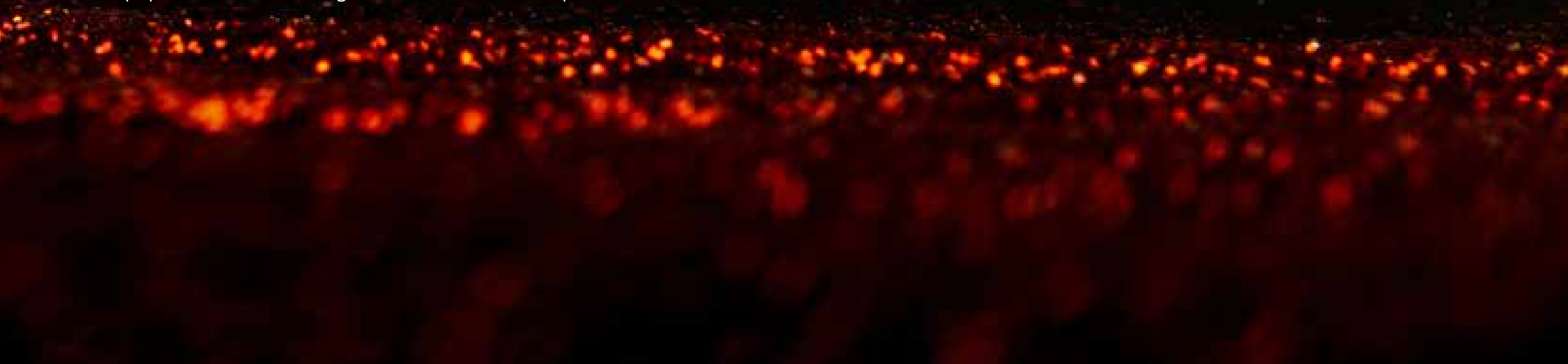
At the present time, files and rasps are predominantly hardened out of a salt bath, that is, they are heated to a hardening temperature (approx. 800°C) in a salt bath and then quenched in water. Some manufacturers of files are still using the now rather rarely applied lead bath hardening method. In some cases induction hardening is already used. Other, newly developed methods are tried out for the purpose of eliminating toxic salt baths.

If correctly handled, heating in a salt bath provides the assurance that there will be no decarbonization of the file surface. This is extremely important, because the teeth of a file must be extremely hard (up to HRC 65) to their outmost tip.

The fact that hardening without distortion is impossible, is known. This fact applies already to relatively plain parts and applies so much more to the files. Tooth cutting, in particular by means of chisel-cutting, generates considerable strains in the material of which the file is made. Additional strains are caused by the straightening process, which is indispensable upon cutting. These strains may result in a more or less excessive distortion in the course of hardening. But the very unfavourable cross sections of files with regard to quenching, particularly the non-symmetrical ones such as the half-round shape, the knife shape and the like, as well as the taper up to the point of a file requires a high degree of experience and skill with regard to the operator handling the hardening equipment, if a low degree of distortion is expected.

Files which have become distorted during the hardening process can be carefully straightened immediately upon quenching as long as the conversion to martensite has not yet been completed. Smaller files which are hardened in complete series at the same time and not individually can still be reconditioned to a given degree later on by slightly heating and aligning on special equipment However, the cutting edges of the teeth must be protected against excessive heat to avoid a decrease of hardness.

The file tang should remain soft to prevent breaking off when the file is put to use later on. For this reason, the tang is not included in the hardening process. To make sure, and also to provide a better look, the tang is additionally annealed in a lead bath or by inductance heating upon cleaning.



8.10 CLEANING

Upon hardening, files and rasps must be cleaned and protected against rust. Cleaning is done by sandblasting, using a fine quartz sand, aluminium oxide or glass powder. The sandblasting may be dry or wet. Wet blasting provides the advantage that the sand particles remain in a combined condition so that the risk of silicosis (dust lung) is eliminated.

The sandblast is guided in such a manner that the cutting edges of the teeth are not blunted but sharpened instead. Sandblasting provides the surfaces of files and rasps with a uniformly grey look.

Instead of sandblasting, the so-called sandsparking can also be applied. In such a case, small steel particles are thrown against surface of file by means of a centrifugal blower.

A washing process follows immediately upon sandblasting and the now metallically clean surface is greased by immersion into a suitable emulsion which leaves a thin oil film as an anti-corrosion protection on surface of file upon drying.

For the sake of completeness reference is also made to attempts for the purpose of replacing the sandblasting by a chemical or electrolytic cleaning process. High costs and environmental reasons have not yet provided the desired success.

8.11 INTERMEDIATE WORK STEPS

In addition to the characteristic operations named above the production of quality files and rasps also requires a number of intermediate steps:

- The cut number and the trade mark or symbol of manufacturer are punched-in at a clearly visible spot.
- Where two toothed surfaces are coming into contact, the edges must be beveled prior to cutting to make room for the burr generated by the raised tooth.
- Upon cutting, the points of various files and rasps require cutting off a remaining head and grinding down of the respective cut.
- After cutting flat files, the uncut narrow side is deburred by grinding.
- At least prior to grinding and upon cutting, but in many cases also upon hardening, the files and rasps must be straightened. No damage to cutting edges is permitted neither when soft or hard.
- Depending on type of files or rasps, additional deburring jobs will be required. Also required may be partial turning, milling and bending jobs.

! The completion of the file requires an average of 37 steps.

THE CUT AND ITS ADAPTION TO THE APPLICATION PURPOSE OF A FILE

Type and version of cut are above all determined by the respective purpose, but also by the manufacturing method applied. The following characteristics are decisive for the shape of a cut in relation to its purpose:

- Desired usage (roughing, smoothing)
- Cutting (chipping) characteristics of the material about to be processed (hard, soft, greasy or sticky)
- Shape of work about to be processed (large surface, sharp burr, thin sheet)

Ideally, these processing criteria require the same type of file teeth and cutting characteristics known from using turning bits, planing bits and cutter teeth, that is, the angles on a file tooth should be adapted to the respective process.

Theoretically, a tile with a purpose-oriented optimal cut can be easily imagined. But there are also manufacturing problems, expensive production methods and high costs to the consumer with regard to keeping all those tiles in stock. For these reasons, and based on the experience gained in the course of time, a number of standard tooth shapes and types of cut have been developed which represent a good compromise between economic production of the respective cut and the intended use of such a tile, which will meet all practical demands.

9.1 THE TOOTH PROFILE

On tooth profiles obtained by chisel-cutting or etching, the respective angles can be influenced within a given range. The rake angle is generally between minus 2° (Fig. 17a)* and minus 15° (Fig. 17b)*. The clearance angle is approximately between 42° (Fig. 17a)* and 28° (Fig. 17b)*. A rough description would be: y will be the more negative and a will be the smaller, the wider the cuts are spaced. But independent thereof, many variations are possible within the range liable to be influenced.

Heavy roughing jobs by means of a tile require sturdy teeth with wide-spaced cuts on a wide face, well related to the tile body. A pertinent tooth shape is shown in Fig. 17b*.

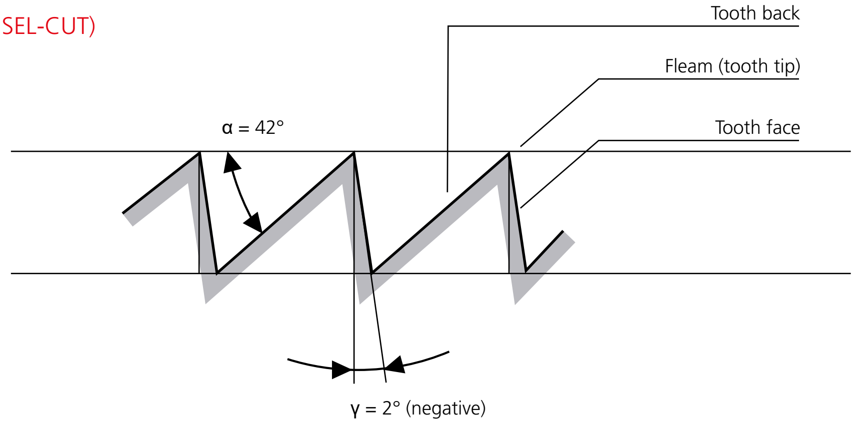
File teeth with more closely spaced cuts for light smoothing jobs are subject to less demands than the teeth for roughing jobs. They permit a tooth profile similar to the one shown in Fig.17a*.

The removal of large chips from soft materials require coarse teeth and good-gripping cutting edges. Milled teeth (Fig. 18)* are meeting these demands particularly well. Milling permits positive chip angles and a well-rounded tooth bottom. Due to the slight resistance of soft materials, the lip angle (wedge angle) can be small. As a result, there are good cutting teeth with large chip spaces which, in co-operation with a cleanly rounded tooth bottom, prevent any sticking of chips and facilitate chip removal.

A look at the tile tooth profile – whether chisel-cut, etched or milled – shows the large clearance angle which deviates considerably from the clearance angles of other tool cutting edges (turning bit, planing bit). This special shape is based on the fact that the chips removed by filing will accumulate for a relatively long period in the spaces between the cutting edges of the teeth. Most of these chips will be able to leave these intermediate spaces only when the respective teeth are no longer in contact with the surface of the work face. For this reason, it is absolutely necessary that tiles are provided with chip spaces of adequate size. This can be done best by means of a large clearance angle α.

*(Fig. 17a, b; 18) see next page

TOOTH PROFILES (CHISEL-CUT)



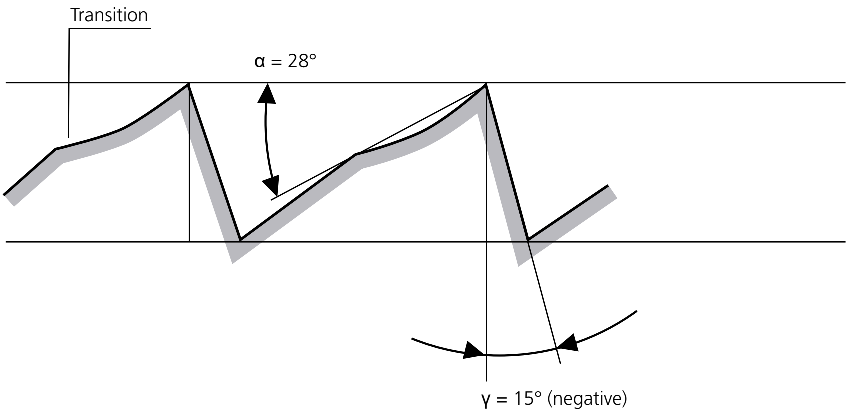


Fig. 17 a and b

TOOTH PROFILES (MILLED)

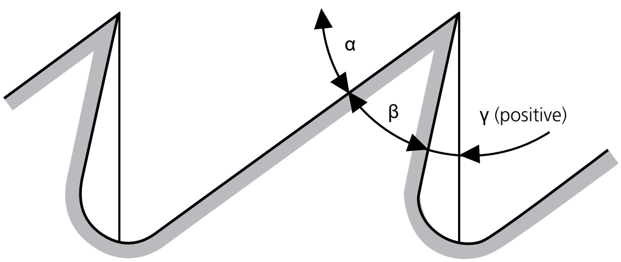


Fig. 18

9.2 TYPE AND LOCATION OF CUT

Next to the tooth profile the type of cut and its location on surface of file are significant. Chisel-cut and etched files are subdivided in single-cut and cross-cut or double-cut files.

The single-cut (Fig. 1) comprises cutting teeth located in parallel with each other and diagonally to direction of file axis. The cross cut (Fig. 2) is obtained by means of two cuts into face of file, on which the overcut, which is cut first, and the subsequently cut upcut are crossing each other. Similar to single cut, the upcut represents the cutting teeth, while he overcut serves the purpose of subdividing the teeth of the upcut into many small teeth which then serve as chip breakers.

Single-cut files are suitable for sharpening saws, because the teeth of the thin and easily vibrating saw blades are best filed with smoothly operating, uninterruptedly cutting teeth. Cross cut files are used for filing larger surfaces. The cross-cut provides the file with good guiding characteristics, while a single cut on faces and edges may result in lateral sliding of file in direction of cutting edges. The chip breaker characteristics of the overcut permit the cross cut to remove only very small chips which can be more easily removed from the teeth than a wide, coherent chip.

The saw file requires no overcut, because it is positively guided in tooth gap of the saw about to be sharpened. The overcut is also losing its importance as a chip breaker, because as a result of the hardness and the minor thickness of the saw blade, small chips will always find enough room behind the saw blade for leaving the teeth.

Similar conditions prevail du ring lathe jobs with a single cut lathe file, if the absence of positive guiding is not taken into account. The many diamond-shaped, small teeth generated by the cross-cut must be located laterally offset one behind the other so that no scoremarks are showing up on the work due to filing (Fig. 2). The offset is attained by selecting the spacing of the teeth measured in axial direction of file for the overcut larger or smaller than for the upcut.

Similar to chisel-cut files, milled files can also be provided with single-cut teeth and teeth with chip breaking grooves (Fig. 3a). This applies both to versions with diagonal cuts and to versions with curved cuts (circular milled).

The slant of the cutting tooth – whether chisel-cut or milled – moves the chips in lateral direction while the file is operated. Curved teeth permit chip flow in both directions.

In addition to the tooth profile and the type of cut, the slant of the cutting teeth also influences the resulting performance. A very slanted cut, that is, a small angle between the file axis and the cut, provides a peeling, chatter-free cut and a smooth surface. In contrast, a cut almost at right angles to axis of file of the type applied e.g. for hardness testing files, is suitable for attaining a direct hold.

The various effects of the different slants of the cutting tooth can be obtained by means of any given slant also by guiding the file to the left or right more or less diagonally in relation to direction of axis. Obviously, this possibility exists only where the required freedom of movement is not obstructed by the shape of the work.

9.3 WORTHWHILE DATA CONCERNING THE CUT

- The machining surface of the file tooth is also called the tooth face and the free surface is called the tooth back (Fig. 17a).

- The part of the tooth back that forms the start of the chip ejection is called the transition (Fig. 17b).

- The outermost sharp tip of the file tooth is called the fleam (tooth tip) (Fig. 17a).

- The size of the cut is not measured by the cut division, but by the number of cuts per centimetre file length, measured in the axial direction of the file. In the case of cross-cut files the number of cuts of the upcut, i.e. the cutting cut, is decisive.

- The number of cuts for rasps is stated per cm².

- The coarseness or fineness designations of the cuts are assigned cut numbers (see cut numbers with the cut types).

- The number of cuts within the same cut number can change depending on the length of the cuts (rated file lengths). The following table corresponds to DIN 8349. It states the number of cuts for engineer files and rasps. Precision files are usually cut more finely than engineer files.

- Cut length or file nominal length is the dimension from tang shoulder to point of file (Fig. 2).

- The cut slant is measured as an angle between the file axis and the cut (Fig. 2). On single-cut saw files it is approx. 60° and on conventional cross-cut files it is 65-70° for upcut and 45-50° for overcut.

- The connecting line of the diamond-shaped sections lying diagonally one behind the other on cross-cut files is called cord or cord line (Fig. 2).

Cut length	**Files, No. of cuts per cm**				**Rasps, No. of cuts per cm**		
	Cut No.				Cut No.		
	1	**2**	**3**	**4**	**1**	**2**	**3**
100	17	23	28	34	–	–	–
125	15	20	25	31	–	–	–
150	13	18	23	28	14	20	28
200	10	15	20	24	11	16	22
250	8	1	17	21	9	12	18
300	7	11	15	19	7	10	14
350	6,5	10	14	17	–	–	–
400	6	9	13	16	–	–	–

SELECTION AND USE OF FILES

10.1 GENERAL

The selection of the suitable size and the correct cross section of a file should present no problem whatsoever. With regard to the cut, the previous explanations will be of assistance to set up a few selection criteria.

Coarse and plain jobs can generally be completed with engineer files (general purpose files). Precision jobs, e.g. in tool making, in precision mechanics, in training jobs and many other applications of a special nature require special files or suitable precision files with acceptable contours, perfect cuts, a good amount of taper in longitudinal direction and high hardness.

In addition, the fact must be taken into account that in view of the multitude of influencing actors outside the range of the actual file itself it will not be possible to associate given versions of file cuts with all practically existing applications in a rigid system of generally valid rules. To find the most favorable cut for difficult cases from the wide variety of possibilities offered, it will be of advantage to perform individual tests at the place of work with reference to the respective case. Tests of this kind can be performed within a reasonable time; the costs for using a few files for this purpose are of no importance.

The known rules for handling and using files are provided by the technical data (refer to list of publications) which are used by modern training centers in their training sessions concerning the basic skills required for metal working.

10.2 FILING HARD OR WEAR – RESISTANT MATERIALS – TITAN FILES

A demand for files to process hard or wear-resistant materials such as highly alloyed steel grades or glass fiber-reinforced plastics lead us to our TITAN files. Our F. DICK TITAN files have a special coating with a surface hardness of 72 HRC for very hard materials.

No blinding, simply beat the file to clean the tooth from chipping. The coating also acts as a rust inhibitor. Last longer than an ordinary file. These coated files are available from F. Dick as precision files and needle files.

10.3 RECUTTING AND SHARPENING OF FILES

In the past, after becoming dull upon use, files were often recut, that is, by grinding off the old cut and applying a new cut they were reconditioned to the extent that they were quality vise about the same as a new file. The price for such a recut file was lower than that of a new file, because material and forging costs were saved.

Depending on the size of file, recutting could be performed once or several times. But a reduction of its cross section and shortening of its length had to be accepted each time.

But since files to be recut were generally not available in the required numbers of the same size for profitable series production, dimensional differences of these files in relation to each other did not permit the compilation of large numbers. As a result, the recutting of files always included an extremely high percentage of wages. Since the fast increase of pertinent wages made recutting unprofitable, recutting had to be abandoned.

There may very well still be a few suppliers of files who are accepting old files for sharpening and will then subject these files to an acid treatment. But this type of sharpening has nothing to do with recutting. The sharpening effect caused by the acid is based on the fact that the softer ferrite in the martensitic structure at the surface of a file is faster wasted than the harder iron carbides, so that the projecting tips provide the misleading concept of sharpened teeth and improved grip. Simultaneously, the tooth shape in range of cutting edges will suffer the disadvantage of a flatening face and back angle. Files sharpened in this matter will therefore not provide an outstanding filing job.

10.4 FILE HANDLE

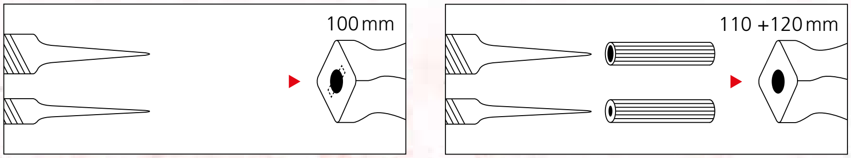
The use of a suitable file handle is important for proper filing. The ergonomic file handle developed by the REFA Institute for Labor Sciences, Handle and Motion Studies, Ludwigsburg (Fig. 19) is recommended because its shape is ideally adapted to the anatomical-physical features of the hand and greatly reduces fatigue during filing (refer to list of publications).

An insert that can be used on both sides is supplied with each file handle (Fig. 20). With the basic borehole in the file handle and the two boreholes in the insert, three different diameters are available which covers almost all tang sizes. No drilling is necessary.

The two-component handle has become very popular (Fig. 21). It combines ergonomics and top design. The rounded contact surfaces and broad thump rest guarantee an optimum grip as well as preventing the file from slipping as it is pushed back and forth.

Fig.19 Ergonomic file handle

Fig. 21 Two-component handle



/ Insert usable on both sides

Fig.20

SMALL FILE DICTIONARY

BRIEF EXPLANATIONS WITH REGARD TO
THE PRODUCTION AND USE OF FILES

A

Aluminium File
also called light alloy file. File with special cut for filing light alloys.

Ampoule File
small saw blade type of file for indenting (and subsequent breaking-off) of glass tubes (medical ampullae).

Arm File
heavy-duty file of square cross sections, length up to 500 mm, lateral length of cross section up to 45 mm, cross section slightly tapering toward point and tang; today of minor significance only. The name probably refers to its size approaching the thickness of a human arm.

Armature Slot-File
long special file for filing armature slots holding the winding of electric motors.

B

Bakelite File
also called plastics file. File with special cut for filing plastics.

Band Saw File
threesquare file of single cut version with relatively large edge radii for sharpening teeth of band saws, with tang and slight cross-sectional taper toward point.

Barrette File
file with barrette-shaped (roof-shaped) cross section, that is, the cross section corresponds to a flat equal-sided triangle (base line larger than each of the two other sides), only the largest side with cut.

Bastard Cut
former name for a coarse cut, corresponds approximately to the present cut No. 1. The name indicates a cut between coarse (cut No. 0) and semismooth (cut No. 2).

Body File
thin file blade for clamping on a holder.

Bone Rasp
special tool with rasp cut (hardly ever with file cut) for surgical purposes.

Buff files
These files facilitate precise work, allowing you to save time and money working on hard materials such as titanium alloys and steel, and also have a long service life since they are high-quality products that are impact- and corrosion-resistant.
• ts profile: there are seven different profiles available: pillar, halfround, round, crossing, three square, square and barrette. Other profiles are available on request.
• Its length : 140 mm (including tang)
• Its cut: anti-corrosive composite abrasive coating that provides a suitable and uniform grain size. This technology allows you to eliminate the marks left behind by the finest files.

C

Cabinet File
similar to cabinet rasp but with file cut.

Cabinet Rasp
Large radius half round, in relation to width a very thin rasp with a slight taper in width toward point. The name is probably based on its use by cabinet-makers for finishing particularly valuable furniture; today often used for making wood patterns.

Carbody File
also called body blade, file blade provided on both sides with teeth milled to a circular shape and suitable for clamping on a holder; predominantly used for finishing automobile body panels, but also for soft metals, wood and plastics.

Chain Saw File
cylindrical file for resharpening motorized chain saws.

Checkering File
also called grooving file, special file for filing grooves e.g. on instrument handles as well as jaws of pliers and pincers. Also to assist design work on gun stocks.

Chisel-cutting (Fig. 15)
production of cut (of file or rasp teeth) by means of driving cutting chisel into file or rasp blank.

Clearing File
other designation for warding file (key file), the name probably based on the "clearing jobs" done on keys and locks.

Clock Hands File
small file of round or square cross section for finish-filing clock hand holes, also called dial file.

Contact File
small special file for cleaning and refinishing contact breaker points.

Cord (Fig. 2)
or cord line, connecting line of the diamond-shaped sections of the cross cut lying diagonally one behind the other and shaped by overcut and upcut. The diagonal cord line is the result of the varying number of cuts of overcut and upcut. The diagonal cord line is necessary to prevent the formation of scoremarks on the work when guiding the file in a straight line.

Cross Cut (Fig. 2)
also called double cut, crossing upcut and overcut.

Crossing File
special file with a cross section composed of two circular segments with radii of different size.

Cut
teeth generated by chisel cutting, etching or milling. Occasionally, the word cut is also used for individual teeth.

Cut No.
indicates coarseness of fine cut. The finer the cut, that is the larger the number of cuts per cm, the larger the cut No. Within one and the same cut No. the number of cuts changes according to file length. The longer the file, the smaller the number of cuts per cm with the cut No. remaining the same.

Cutting Chisel (Fig. 15)
chisel-type tool for generating the file and rasp cut; for files usually carbide-tipped.

D

Dental File
half round file with steel handle instead of a tang, for dental work.

Dial File (refer to clock hands file)

Diamond File
file with its surface coated with diamond chips. Mainly for needle files and small machine files; used for refinishing hardened parts above all for toolmaking.

Testing File
(refer to hardness testing file) often so-called like that because of its former use for testing thread-cutting dies.

Displaced Metal
the displaced portion of the file tooth raised above the file blank surface. It forms the cutting edge of the tooth; applies similarly also to rasp tooth.

Doctor Blade File
special file for finishing doctor blades. Doctor blade: a scraper used in the printing industry for wiping-off excess printing ink.

Double Cut (refer to cross cut)

Double Smooth-Cut File
former designation of a very fine cut, corresponds approximately to the present cut No. 4.

E

Emery File
wooden body lined with emery paper.

Engraving Riffler
or engraver's riffler file, small light weight version of a riffler available in a number of cross sections; particularly suitable for engravers, chasers and for working gold.

Engineer File (G.P. File)
file for general requirements usually made of unalloyed carbon steel in one of the conventional cross sections.

Equalling File
thin file of rectangular blunt shape with tang for finishing slots of needle beds on textile machines; also used for toolmaking and other precision jobs.

Escapement File
small file with very fine cuts, and a shank to be used as a handle. With conventional cross sections originally for refinishing jobs on movement or escapement (balance wheel and yoke) in clockwork. Today predominantly for work in precision-mechanical range. Escapement: device between clockwork and regulator responsible for controlling unrestricted operation of clockwork mechanism.

Escapement Yoke File
small special file for refinishing escapement yoke (in clockwork) during repairs.

Etching File
a tool used in file making for producing the cut by etching consists usually of a threesquare rod with heavily rounded edges, which are provided with a sharp special cut.

Etching of File Cut
cutting method where the etching file serves as a tool. This file is guided across the file about to be processed under the required pressure several times back and forth. The pressure of the teeth of the etching file provides the required "cut" on surface of the file manufactured.

F

File
multi-edged hand or machine tool for chip removal by means of a reciprocating or rotating movement, provided with continuous line-shaped cuts, either chisel-cut, etched or milled teeth, called cuts; used for filing metals, plastics, wood. Origin: Germanic root word.

File Blade (Fig. 18)
made of thin, hardened steel sheet; tooth edges are formed by the bent up (raised) edges of cutouts; clamped on a pertinent holder and handled like other files; also applicable as a round disc for rotary movement; suitable for filing soft metals, wood, plastics and other soft materials.

File Disc (Fig. 8)
round disc with file cut for clamping on special filing machines (Fig. 9) (also on lathes, milling machines and the like) for rotary operation.

File Drum
drum-shaped body with cuts in parallel with direction of axis, mainly used for making needles clamped together with other coarser or finer filing drums on a mandrel and used as a rotating body for processing brass needle tips, but also for other purposes.

File Plate
thick rectangular plate (up to 500 mm long and 250 mm wide) with file cuts on both flat sides; used for draw filing and for equalizing and touching-up rough spots, mainly at edges on hollow bodies.

File Rasp
file-like tool, generally of rectangular blunt version, one face with file cut, the other with rasp cut.

File Tooth (Fig. 16 and 17)
cut or etched version: single cut, comprising the lower portion recessed in file body and the upper portion raised above file surface; also name for milled (machinecut) tooth.

Filing Machine File (Fig. 5)
parallel file with conventional cross sections and two clamping ends for clamping in a filing machine (Fig. 6) with reciprocating motion generally in vertical direction.

Fishskin Cutter
bent riffler for gunsmiths, name is based on the fishskin-like look of its working face.

Fitting File
small file bent upright of rectangular cross section for shoemakers; of no significance now.

Fiat Rubbers
heavy-duty file with rectangular cross section, length up to 500 mm, lateral length ratio of cross section approx. 1 : 1.6, width and thickness slightly tapering toward point and tang; now of only slight importance.

Fork File
thin flat file with tang and rounded-off narrow side, its width slightly tapering in forward direction; used for deburring jobs on table forks, now often used for other purposes, e.g. for toolmaking.

Fork File Disc
round disc with file cut used as a rotating tool for deburring jobs on table forks.

Fork Milling Disc
round disc with milled teeth used as a rotating tool for deburring jobs on table forks.

Fork Tip Milling Disc
round disc with milled teeth and tapering thickness in outward direction, formerly used as a rotating tool for finishing the tips of fork tines.

Fretsaw File
special file for filing teeth of fretsaws.

G

Grooving File (refer to checkering file)

Gunsmith File
special file for gunsmiths. Made in various cross sections and versions. Similar files are the notch file, the sight file and the fishskin-pattern file.

H

Habilis files
Needle file-like files/forms, however with strong, forged square shaft and reinforced cross-section. These files do not need a handle.

In particular, these are highly suitable for production of tools and moulds because the files have tapered profiles. The files allow a higher work pressure than needle files.

Half Round Files
file with half round cross section, or more accurate cross section like a segment of a circle.

Ratio thickness : width
for precision files approx. 1 : 4
for engineer files approx. 1 : 3

Hand File
file with rectangular cross section and of uniform width throughout. Thickness tapering toward point, one safe edge, lateral length ratio of cross section approx. 1 : 4

Handle (Fig. 19)
file handle, a handle made of wood or plastic material placed on file tang for holding and guiding the file.

Hardness Testing File
also called probing file, file with special cut and high hardness (obtained by special treatment) for hardness testing work above all for twist drills and roller bearings; not suitable for standard filing jobs.

Heel
(Fig. 2) The uncut, blanc surface of the file between end of cut and shoulder of tang.

Hoof-cleaning Rasp
S-shaped rasp with rectangular cross section for finishing the cut hoofs of cattle.

Hoof Rasp
large rasp of rectangular cross section with a very coarse rasp and partially file cut to care for hoofs and claws.

Horse Tooth Rasp
rasp plate attached to a long grip for filing the teeth of horses.

J

Joint File
round cylindrical version for refinishing hinges of watch covers, flat version (only narrow, rounded-off sides provided with cut) for refinishing hinge members in watch cases.

K

Key File
small file with one of the usual cross sections for finishing keys and locks, slightly thinner than usual files of the same size, also used for other minor filing jobs.

Knife File
file with knife-shaped cross section, that is, the shape of the cross section corresponds to an equal-sided triangle with its base line smaller than each of the two other sides.

L

Lathe File
rectangular blunt file, no taper (of uniform width and thickness along entire length) with special cut (smaller angle of diagonal cut), for lathe jobs, single cut and cross cut version.

Leading Cut (refer to trailing cut)

Length of Cut (Fig. 2)
nominal length of file, the dimension from tang offset (also called shoulder) up to file point (including uncut heel).

Light-alloy File (refer to aluminium file)

Link File
made in various cross sections and provided with holes for attachment on an endless belt; for continuous filing on band filing machines or band saws.

M

Machine Band Saw File
single cut threesquare file, parallel version with relatively large edge radii for sharpening teeth of band saws, with 2 clamping ends for clamping into saw sharpening machine.

Machine Saw File
single cut threesquare file in parallel version for sharpening saw teeth (mainly on circular saws for wood) with two clamping ends for clamping into saw sharpening machine.

Milled Tooth File (refer to carbody file)

Milling Disc (Fig. 8)
round disc with milled teeth for clamping on special filing machines (Fig. 9) (also on lathes, milling machines and the like) for rotary operation.

Mill Saw File
rectangular blunt saw file, not tapered (of similar width and thickness along entire length), single cut, narrow sides (flat or rounded) also cut; for sharpening foresttype circular saws, but also for sharpening planing and machine-cutting knives.

Multi-purpose File
versatile file generally rectangular blunt, with special cut for coarse and smooth filing of various materials.

N

Nail File
small file for manicuring purposes.

Needle Bed File (refer to slot file and equalling file)

Needle File (Fig. 12)
thin, partially needle-shaped pointed file with a round grip used as a handle; cross sections are conventional and the file is mainly used for toolmaking and by the jewellery and ornaments industry.

Notch File
formerly also called sight file, special file used by gunsmiths for working on sight (notch and bead), also refer to gunsmith file.

Number of Cuts
on files number of individual cuts per cm, measured in axial direction of file; on rasps number of individually formed teeth per cm^2.

O

Overcut (Fig. 2)
teeth not sharply cut and located parallel in relation to each other and diagonally in relation to direction of file axis. Serves the purpose of subdividing the teeth of the upcut applied later on to form chip breaker grooves. Facing the file face (tang below, point at top) the overcut runs from bottom right to top left.

P

Pansar File
Swedish term for file with milled, curved teeth.

Pillar File
narrow version of a hand file, with 2 safe edges if very fine cut; due to its favorable cross section often used for toolmaking and other precision jobs.

Pivot File
small special file for filing pivots of clockwork mechanism.

Pivot Polishing File
small special file for polishing clockwork pivots.

Plastics File (refer to bakelite file)

Precision File (Fig. 11)
file for precision jobs in one of the conventional cross-sectional shapes, particularly characterized as follows: made of higher-grade steel, high hardness, careful completion of cut and shape, slim, smooth taper, finely tapered point, sharp edges.

Probing File
(refer to hardness testing file)

R

Rail Planing File
large file blade similar to carbody blade, formerly used in combination with a pertinent holder to refinish weld spots and distortions on streetcar and railroad rails.

Rasp (Fig. 4)
file-like tool, differs from file by the rasp cut formed in the shape of dots used for processing wood, leather, cork, horn, rubber, plastics, stone.

Rasp Disc (Fig. 8)
round disc with rasp cut for clamping on special filing machines (Fig. 9), also on lathes, milling machines and the like, for rotary operation.

Rasps for pattern makers
Differs from standard rasps by more precise manufacturing and extra fine rasp cuts. The point-shaped teeth are irregularly placed, which gives a similar result as hand-cut rasps. It will leave an even surface, combined with a longer lasting cutting of a machine cut.

Reciprocating File
small file clamped into a portable machine driven by an electric motor or by compressed air to provide the reciprocating movement.

Refinished File
reconditioned dull file by annealing, grinding down of cut, recutting and hardening.

Riffler File (Fig. 13)
file with long gripping shank, at both ends of which is a short, usually bent file blade cut as required. The file bodies are in the usual cross sections and generally bent in opposite directions (S-shaped). The riffler is preferably used for tool and pattern making, jewellery and ornaments industry but also by sculptors (for this reason occasionally also called sculptor's file).

Riffler Rasp
differs from file-type riffler by its own rasp cut, used above all for making wood patterns.

Ring File
high half round prec1s1on file, mainly for processing finger rings.

Rolling-burnishing File (refer to rounding-off polishing file)

Rolling Disc
Disc-shaped tool with roughened active area cutting faces for rotary Operation. Mainly for improving surface finish on shaft pins in the precision engineering industry.

Rotary Burr (Fig. 10)
similar to turbo file but different from the latter by its milled teeth; partly made of high speed steel, but today predominantly of carbide metal with ground teeth.

Rotary File (Fig. 10)
small rotary file up to approx. 30 mm dia of various shapes from cylindrical to ball shape, with shank or threaded bore for mounting in a portable machine driven electrically or by a pneumatic motor.

Rotary Rasp (Fig. 10)
similar to turbo file but different from the latter by its special rasp cut.

Rough File
old designation, refer to general purpose (g.p) file.

Round File
file with circular cross section, usually tapering toward point.

Rounding-off Polishing File
also called roll-polishing file. Small special file with very fine cut or ground cross cut for rounding-off and polishing the faces of balance and wheel pivots in clockwork mechanisms.

S

Saw File
threesquare file for sharpening saw teeth, preferably single cut versions, with tang and slight taper toward point. In addition, saw files with various other cross-sectional shapes are used for special saws.

Screwhead File
sword-shaped file for refinishing small screw head slots.

Sculptor's File (refer to riffler)

Sharpening File (refer to saw file)

Shoemaker's Rasp
specially shaped rasp suitable for shoemakers for processing leather, rubber, wood, cork, plastics.

Shoulder (Fig. 2)
tang shoulder, the place on file where the tang begins.

Sight File
special file used by gunsmiths in parallel version, its cross section forming an equilateral triangle, only one flat side provided with a cross cut.

Silver Riffler
or silver riffler file, larger heavy-duty version of a riffler, in various cross sections, formerly often used by silver and brassworkers (bucklemaker).

Single Cut (Fig. 1)
cutting teeth located in parallel whith each other and diagonally in relation to axis direction of file. When facing the file surface (tang at bottom, point at top) the single cut runs generally from left bottom to top right. The single cut mainly applies to saw files.

Slant of Cut (Fig. 2)
Location of cut in relation to longitudinal axis of file. Dimension given for slant of cut is the acute angle formed by the cut and the longitudinal axis of the file.

Slant of cut generally for
single cut approx. 60°
upcut 65-70°
overcut 45-50°

Slitting File (Feather Edge)
file in parallel version with sword-shaped cross section, that is, the cross section corresponds to a flat rhomboid.

Slot File
also called bed file, thin file in rectangular blunt version, without tang, preferably used for filing slots of needle beds on textile machines.

Smooth Cut
former designation of a fine cut, corresponding approximately to the present cut No. 3.

Soft Metal File (refer to tin file)
Spacing distance from one cut to the next measured in axial direction of file.

Square File
file of square cross section tapering toward point.

Stereotype File (refer to type-correcting file)

Stitchhole File
small pointed file of round, threesquare or square cross section for filing various holes of clockwork. Obviously, the name is based on its former use in sewing machine construction, where this file served for filing the stitchhole in the stitchplate. „Studel" File
a name applied in Austria to key or clearing file.

T

Tang (Fig. 2)
narrow, pointed rear end of file which fits into the file handle made of wood or plastics.

Threesquare File
a file with the cross section of an equilateral triangle, tapering toward point.

Tin File
also called soft metal file. File with special cut for filing soft metals.

Tin Planer
special file with milled cut, convex face and offset tang; suitable for filing soft metals, above all for removing and cleaning excess tin and remainders of zinc on body panels.

Touchstone File
a no longer manufactured hardness testing file with square cross section and a square stub instead of a tang.

Trailing Cut
of significance for file discs and milling discs. If the cut on these discs runs from one point on circumference in direction of disc center, the cut is called a radially located cut. If the cut starting at one point along circumference is placed as a tangent against a circle of which the diameter is smaller than the outside diameter of the disc, two angular positions in relation to radial are possible. If the angle is such that the removed filing chips are traveling outwards, that is toward edge of disc, when the disc is operating in cutting direction, the cut is called a „trailing" cut. The cut is „leading" if its angle in relation to radial is such that the removed filing chips are traveling inwards when the disc is operating in cutting. Since the terms „trailing" and „leading" may result in confusions, they should preferably not be used. It would be better to say in which direction the chips are expected to flow.

Tuning File
small flat pointed file for filing small tuning reeds on mouth-organs for tuning the respective pitch.

Type-correcting File
or stereotype file, small file with coarse cut rectangular to file axis for pulling cut (tooth pointing in direction of tang), for working on printing blocks; today no longer of significance.

U

Upcut (Fig. 2)
cutting teeth parallel in relation to each other and diagonal in relation to direction of axis, chisel cut or etched upon application of overcut. Facing the file face (tang below, point at top) the upcut proceeds generally from below left to top right.

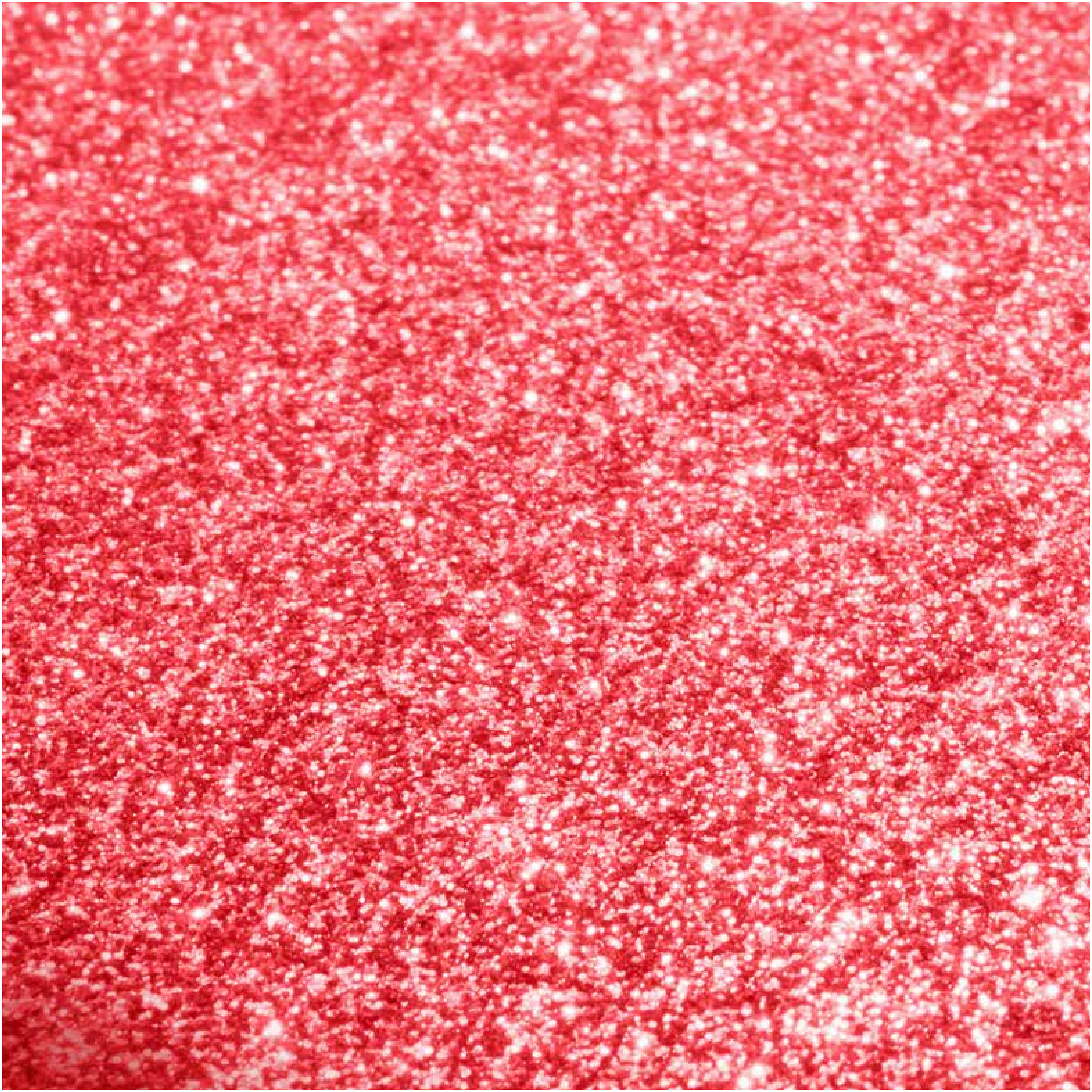
W

Warding File
file with rectangular cross section, width and thickness tapering toward point, cross section similar to rectangular blunt file.

Watchmaker's File
formerly a collective term for the files needed by watchmakers; formerly also the name for pointed precision files of all sizes in general production range.

Wave Cut
cross cut with wave-type cord line. The line results from the periodic increase and reduction of overcut spacing while cutting.

Wood File
file with special cut for fine-finishing of wood.



LIST OF PUBLICATIONS

B. Buxbaum	Feilen (Werkstattbücher Heft 46), zweite Auflage, Springer-Verlag Berlin / Göttingen / Heidelberg 1955
Deutsche Normen	DIN 7261, DIN 7262, DIN 7263, DIN 7264, DIN 7283, DIN 7284, DIN 7285, DIN 8349 Beuth-Vertrieb GmbHBerlin-20 und Köln
O. Dick	Die Feile und ihre Entwicklungsgeschichte, Verlag von Julius Springer, Berlin 1925
Forschungsberichte des Landes Nordrhein-Westfalen	herausgegeben durch das Kultusministerium, Nr. 781, Verformungseinflüsse bei der Feilenherstellung, Westdeutscher Verlag/ Köln und Opladen 1959
Grundfertigkeiten Metallbearbeitung	Feilen, Sägen, Meißeln, Scheren, Schaben, Pressen, Passen, 6. überarbeitete Auflage, herausgegeben vom Bundesinstitut für Berufsbildungsforschung 1976, Beuth-Verlag GmbH, Berlin, Köln, Frankfurt/M.
J. Solf	Kleine Griffkunde oder: Was der Designer vom Ergonomen lernen kann, in Broschüre Bundespreis „Gute Form 1975“, Verlag Rat für Formgebung, Darmstadt
J. Solf	Ergonomische Gestaltung eines Feilenheftes TZ für praktische Metallbearbeitung, 71. Jahrgang, Heft 1, Januar 1977. Abbildungen 6 und 9 wurden vom Bundesinstitut für Berufsbildung (BIBB), Fehrbelliner Platz 3, 1 Berlin 31 zur Verfügung gestellt.

KEYWORD INDEX

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