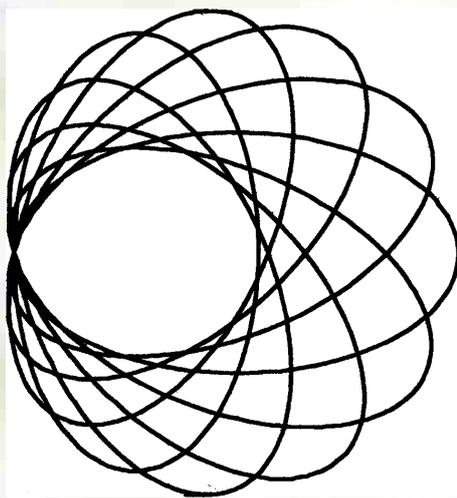


OVALTURNING



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www.Volmer---Ovaldrehen.de

Third edition

Chemnitz, 1. August 2012

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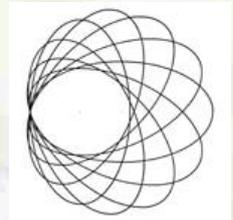
Preface of the third edition

The script Ovalturning, in its German and English versions, has met the interest of many thousands of woodturners. It has clearly contributed to making Ovalturning known to ever wider circles of woodturners and a good many have taken it up. Given the lack of ovalturning equipment on the market, some have built their own oval chucks, some of them with the Volmer Ellipse mechanism, which is the basis of both, the picOval lathe of STEINERT as well as the VICMARC Ovalturning Device VOD.

For German speaking woodturners the **Drechslerforum** (www.drechsler-forum.de) is the ideal source and exchange of practical experience in ovalturning techniques, devices and machines as had been intended with the Elliptical Turning Association that I founded, after 1990, jointly with my longstanding English friend Bill Newton (1940 - 2009).

Since publication of the second edition in 2006, a lot of practical experience and new conclusions were made, papers on ovalturning were written, and many addresses have changed. Thus an update of the script is clearly indicated.

I wish everybody involved in ovalturning rewarding success and pleasure. Any contribution toward improvement and updating of the script is always highly welcome. Cordial thanks to my helpers Gerhard Ehrlich, David Springett and Hanspeter Bodmer.
Johannes Volmer



1 The History of Ovalturning

Ovalturning is an old turning art, which has been practiced in Europe since the 16th century, in order to produce oval articles. There are examples in museums such in the ivory collection of the Green Vault in Dresden ([1.1.5](#)¹⁾). Figure 0302 shows an oval turned lidded goblet by Egidius Lobenigk, dated 1586. Lobenigk was one of the famous court turners of Elector August of Saxony, who governed 1553 - 1586.

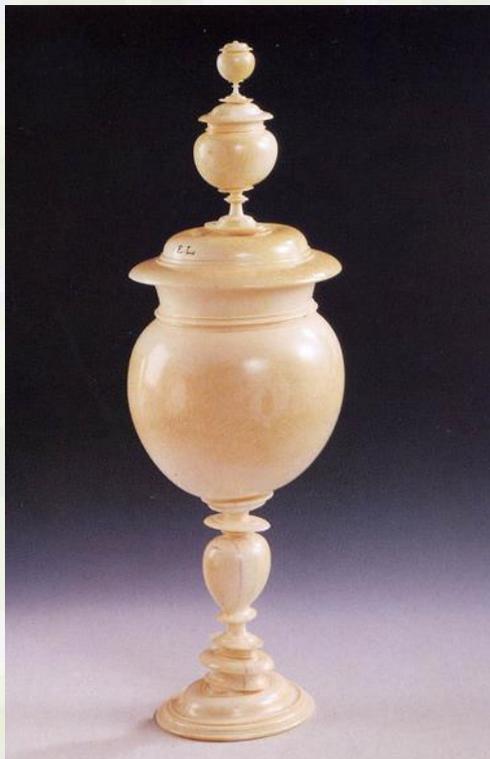


Figure 0302 Oval lidded goblet by court turner Egidius Lobenigk 1586 Dresden State Art Collection Dresden Grünes Gewölbe (Green Vault) ([1.1.5](#))

1 The History of Ovalturning

The turners and mechanics working at the European courts were the creators of the lathe mechanisms which allowed ovalturning and other complicated turned artworks to be produced. It was, above all, the oval chuck, the invention of which is attributed in principle to Leonardo da Vinci (1452 - 1519), which allowed the production of accurate elliptical forms. The court turners were also required to instruct their sovereigns at the lathe and to educate the princes in the correct form of manual work [\[1.1.3\]](#).

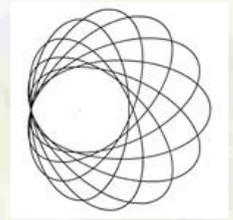
Oval picture frames, for which the elliptical form was particularly appropriate, became very fashionable in the 19th Century when portrait photography spread. Oval frames for pictures and mirrors were turned, by hand, at ovalturning lathes in great quantities in frame making factories. Such frame factories were to be found throughout Germany but today, unfortunately, none remain. In the "Handbuch der Ovaldreherei" (Handbook of Ovalturning) of 1920 the production of oval frames is described in detail [\[1.1.1\]](#). In the USA one frame factory, founded in 1864 by German immigrants, remains preserved as working museum [\[2.2.1\]](#) [\[2.2.11\]](#) [\[2.2.12\]](#)[\[5.10\]](#). One can study there the function of the ovalturning lathes of the 19th century. Since ovalturning required special skill the ovalturner was, among the turners, a well paid specialist. The ovalturning of frames disappeared from the workshops and factories when oval frames went out of fashion and particularly when faster milling machines were introduced. However, the variety of profiles obtained by ovalturning could not be achieved by milling.

Although ovalturning has lost its importance as production technology today, it is of increasing interest to artisans, the restorer and for those turners who want to experience the stimulating characteristics of ovalturning. There are substantial differences between the use of hand tools when ovalturning compared to the tool use when plain (or circular) turning.

There is only one specialist requirement for ovalturning, and that is the Oval Chuck. These chucks were commercially available until the 1950's. Today these early chucks are only found in old professional woodturner shops or by chance as popular rarity. Some individual turners have built themselves oval chucks based on old models. There is even an instruction to build an oval chuck from wood for study purposes [\[1.2.4\]](#). Johannes Volmer, from Chemnitz in Saxony, has been with ovalturning and designing ovalturning devices and lathes since 1980. One of his prototypes was used by the Australian lathe manufacturer VICMARC [\[5.1\]](#). Dan Bollinger in the USA [\[5.3\]](#) has built a variant of the Volmer lathe. Other enthusiasts throughout the world followed him with shop-made ovalturning devices using the principle of Volmer's Ellipse mechanism (see [figure 3401](#)). In March 2006 the craft supply Steinert® in Germany presented the small ovalturning lathe picOval [\[5.4\]](#).

While the capacity of the classic oval chuck is limited by its imbalance and while its moving parts have to be constantly lubricated and maintained, these disadvantages are eliminated with the Volmer Ovalturning Lathes ODM (Ovaldrehmaschine) - which run smoothly at high speeds usual for turning wood.

¹⁾ Numbers in [] refer to the bibliography (Literature)



2 What is Ovalturning

2.1 Ovalturning Definition

Ovalturning is the turning of a workpiece on a turning lathe provided with an oval chuck or on an ovalturning lathe. The turning tools were freely guided by hand. That applies generally to the turning of wood as with the normal (circular or plain) turning. When turning hard materials e.g. bone, ivory or soft stones (serpentine, alabaster, steatite) it may be necessary to clamp the turning tool in a compound slide rest. Turning tools are gouges and scrapers (profile ground) as used when woodturning. The use of routers or rotary cutters to produce a profile on an oval workpiece should not be called ovalturning but ovalmilling. When milling so called parallel curves of the ellipse are produced. They are not ellipses but regarded as ovals.

When ovalturning, using the classic oval chuck, the workpieces have an exact elliptical cross-section. Therefore the name Ellipse Turning or Elliptical Turning would be acceptable. Since the ellipse is a symmetrical oval [2.2.5], the name ovalturning is also correct, and besides, this name has been used for centuries and is more easily pronounced.

2.2 Comparison of Circular Turning and Ovalturning

Ovalturning shows, in comparison with normal turning – in the following called circular turning – essential differences. These differences are caused by the Ellipse Motion of the workpiece. This motion influences the cutting of the workpiece material, the guiding of the cutting tools, and the design of the workpiece shape.

The drawing in figure 1101 shows the Ellipse Motion. The elliptical workpiece is drawn in 8 positions. It is guided to these positions by the oval chuck or the ellipse mechanism. Point C is the cutting point of the fixed tool T on the tool rest TR. While the ellipse is going through its position the ellipse midpoint runs along a circle the diameter of which equals the difference of the ellipse half-axes. For half a revolution of the ellipse its midpoint runs around the entire circle.

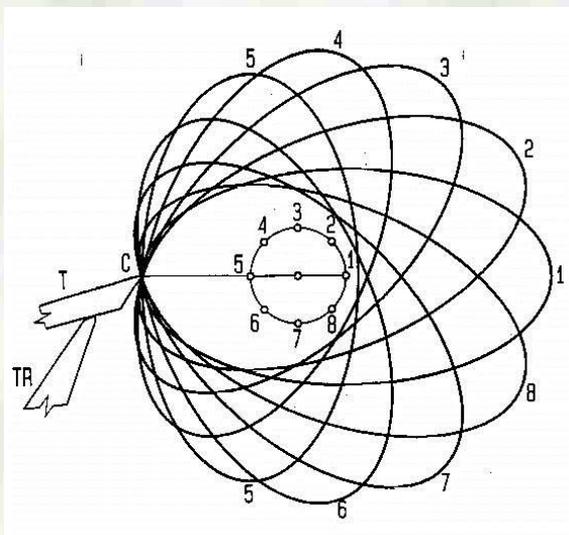


Figure 1101 Ellipse Motion

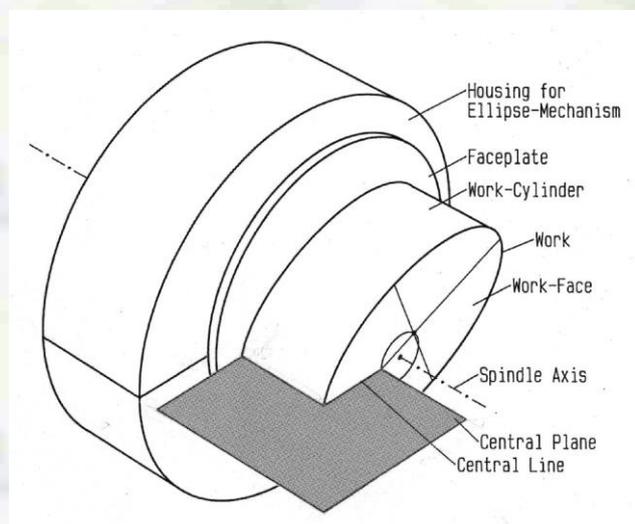


Figure 1102 Central Plane

For the explanation of other important terms look at figure 1102 in which an oval cylinder is fixed onto the faceplate of the ovalturning lathe. In this drawing the Central Plane is marked.

2 What is Ovalturning

This is an imaginary horizontal plane exactly at centre height. The Central Plane the Central Line marks on the workpiece. This line is of essential importance as the cutting part of the tool edge should always be guided exactly on this line.

Considering the cutting process: There are differences between the shaving removal on the work-cylinder and on the work-face. When circular turning, the surface of a cylindrical workpiece will form constant angles with a fixed tool edge. On an elliptical work-cylinder the angles alter periodically during the revolution. Thus, the cutting forces acting at the tool edge are also changing. The ovalturner has to take this alteration into account when guiding the tool for optimum cutting conditions to yield clean, shearing cutting and smooth surfaces. This is especially important when ovalturning wood. The materials preferred by the court turners were ivory and ebony for a “scraping” cut can produce a smooth surface because of the isomorphic structure of those materials.

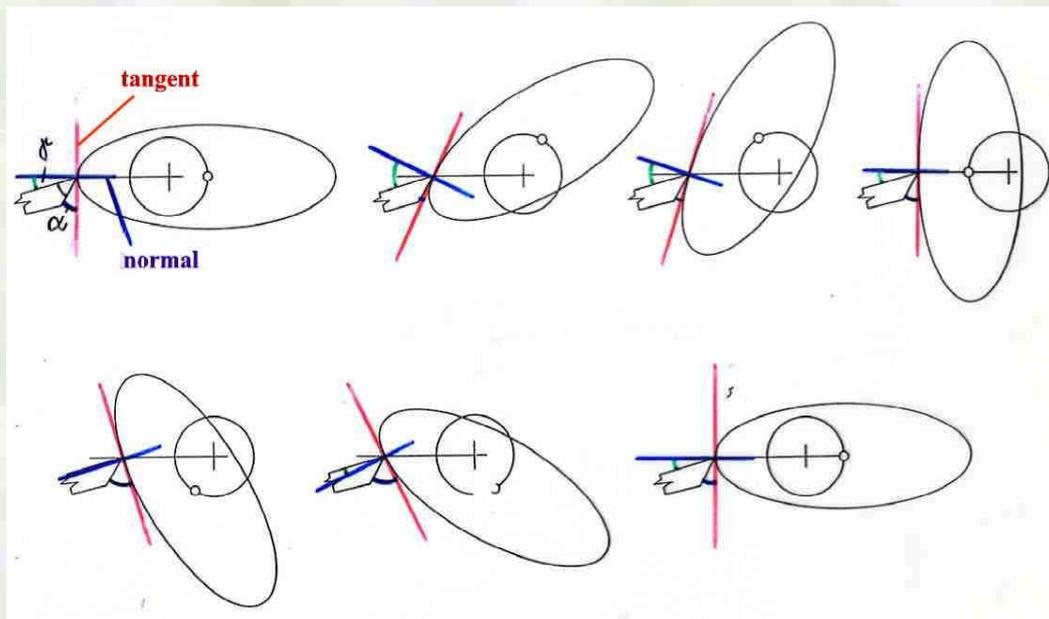


Bild 1103: Alteration of the rake angle γ and the clearance angle α

Figure 1103 shows the alteration of the angles which are important for chip formation: the clearance angle α (alpha) and the rake angle γ (gamma) when cutting the work-cylinder. At the work-face these angles remain constant. Another difference from circular turning is that, that the material to be cut runs with periodically altering speed over the tool edge. The cutting forces consequently also changes. The ovalturner will feel this at the tool handle.

When circular turning the work-face it does not matter along which Cutting Line the tool edge is guided to the centre because concentric circles are always generated. When ovalturning the Cutting Line is important. In figure 1104a the edge is guided along the [Central Line](#). Cutting Line and Central Line are identical. The results are concentric coaxial ellipses or “parallel” ellipses. If the cut is not made along the Central Line, as shown in figure 1104b, concentric ellipses are produced but they are twisted to each other. All these ellipses have the same axes difference (sway). This is the parameter for adjusting the oval chuck. With circular turning the work-face has in the centre a point, with ovalturning you obtain a line.

2 What is Ovalturning

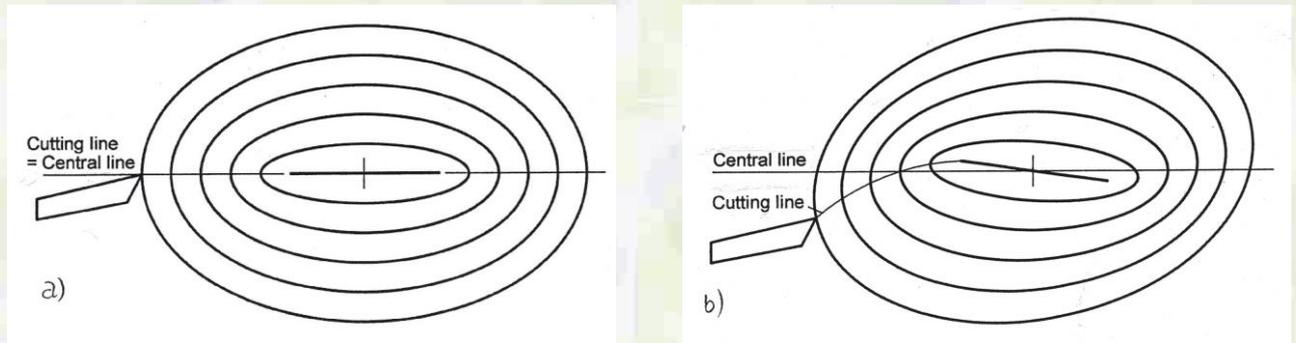


Figure 1104 Cutting Line and Central Line

The art of ovalturning resides in the skill to guide the cutting area of the tool edge exactly, and unwaveringly, along the central line. Already minimal deviations have noticeable consequences on the surface. One recognizes this on the surface of facing grooves. Figure 1105 illustrates this. The tool edge, when above the central line, will cut an ellipse that penetrates the centrally cut ellipse in two opposing places.

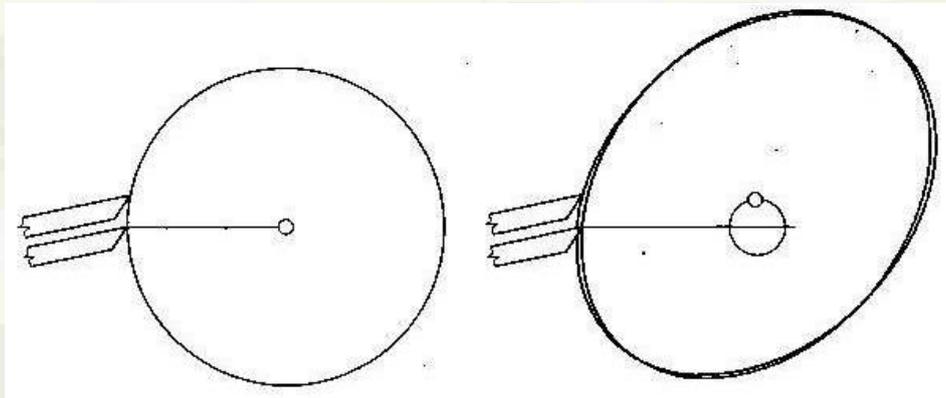
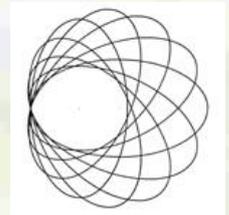


Bild 1105 Two concentric circles and two concentric ellipses twisted and penetrating each other

As a technical aid for making the central plane and central line visible J. Volmer uses a [lightline](#) projector (see Figure [5102](#)).



3 Ellipses-Geometry

The ovalturner should know at least the following about ellipses from his school books.

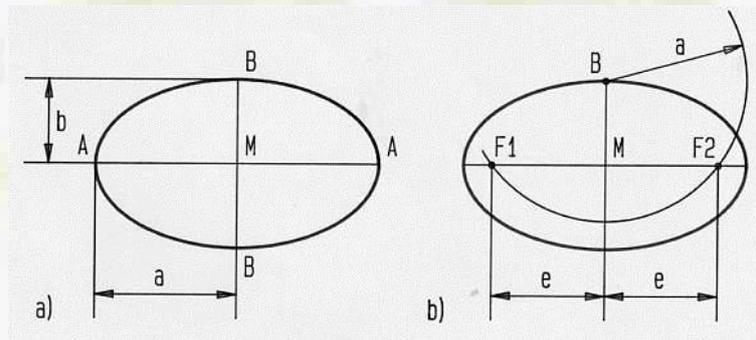


Figure 2101 Ellipse axes and linear eccentricity

- a) Half-axes (semi-axes) a and b
 b) Foci (foci) F_1 and F_2

The ellipse is a conic section; it is produced if one cuts through a circle cone or a circular cylinder diagonally. The ellipse has two axes which are perpendicular to each other at the centre M (Figure 2101a). The half-axes have the length $AM = a$ and $BM = b$. The half-axes are the two important parameters for ovalturning. They are most often provided. To adjust the ovalturning lathe the

Half-axes difference $d = a - b$

is the essential parameter, not to confound with the

axes ratio $\beta = b/a$,

abbreviated by the letter β (beta). It plays a role in the adjustment of the Indexer. Another measure is the

linear eccentricity e .

It is not needed for the adjustment of the ovalturning lathe, it is however necessary when drawing the ellipse using the thread construction (gardener construction). The linear eccentricity is the distance of the two foci F_1 and F_2 on the large axis from the centre M of the ellipse. One locates them by drawing a circular arc around B with the radius a (Figure 2101b) or with the formula:

$$e = \sqrt{a^2 - b^2}.$$

The ellipse perimeter u is also important. It cannot be calculated accurately, so an approximation formula is used as follows:

$$u \approx \pi (1,5(a + b) - \sqrt{ab}) \quad \text{or with: } \beta = b/a$$

$$u \approx a \pi (1,5(1 + \beta) - \sqrt{\beta}).$$

The area A of an ellipse is $A = ab \pi$.

3 Ellipses Geometry

The simplest method of drawing an ellipse is the thread construction, e.g. for making and cutting an elliptical blank from a board or a block. Draw the two axes AA and BB of the required lengths, with the intersection M, on the board, set a pencil compass to the half-axis length $MA = a$ and draw an arc - as in Figure 2101b - around one of the end points B of the short axis. It will cut the large axis in the two [foci](#) F1 and F2. Fix nails into these points and also into one of the B points. Draw a thread loop around these 3 nails knotting at the extreme ends (Figure 2102a). Pull the nail from point B and draw the ellipse with a pencil. Keep the thread tight when drawing the ellipse (Figure 2102b).

Thread construction of the Ellipse

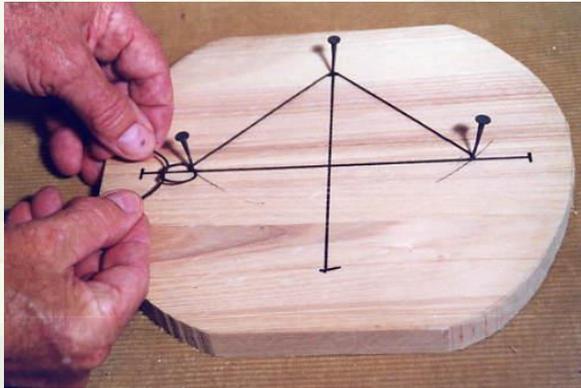


Figure 2102a Thread ring around three nails

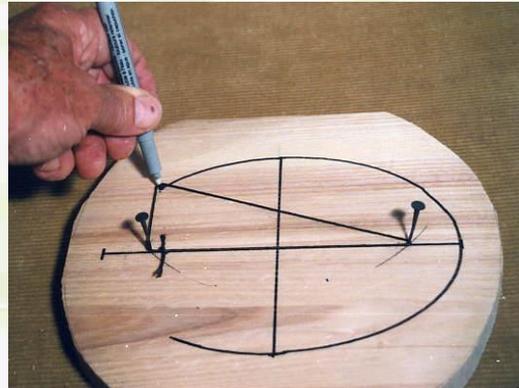


Figure 2102b Drawing the ellipse

Ellipsographs are mechanisms, which guide a pencil or pen for drawing an ellipse onto a fixed drawing board. Instead of the pen a glass cutter or a knife may be used for cutting glass, paper or cardboard as frame inlays. The ellipse axes can be adjusted at the ellipsograph. The kinematic principle of the ellipsograph is achieved by using the [double slider linkage](#), the trammel (Figure 2103). The sliders 2 and 4 run in stationary cross slot 3. They are connected in their joints A and B by a coupler 1, the point C of which writes the ellipse k_C into the stationary plane. The adjustment of the required half axes is calculated by the distances $BC = a$ and $AC = b$. The distance $AB = a - b = d$ is the half-axes difference. The midpoint M of the distance AB runs along the circle k_M around the ellipse centre M_0 . The radius of this circle is $r = d/2$.

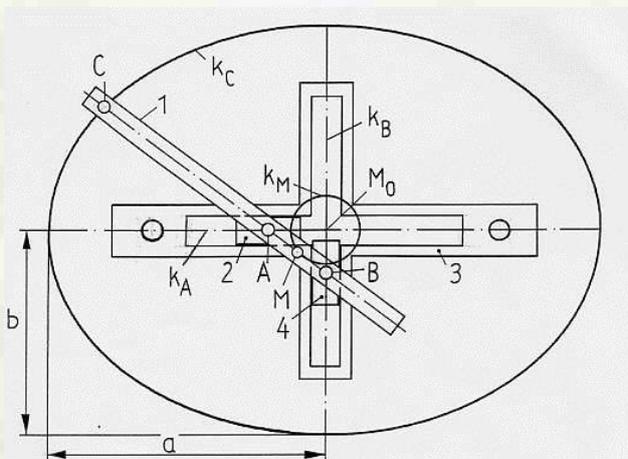


Figure 2103 Kinematic scheme of the Ellipsograph (trammel)

Using the Ellipsographs shown in the following figures ellipses can be drawn and, if the pen/pencil is substituted by a knife, paper or card ellipses may be cut out. When cutting glass exchange the pen/pencil with a glass cutter.

3 Ellipses Geometry

Figure 2104
Ellipse- and Circle-Glass-Cutter
(Firma J. Bohle, D 42755 Hann)

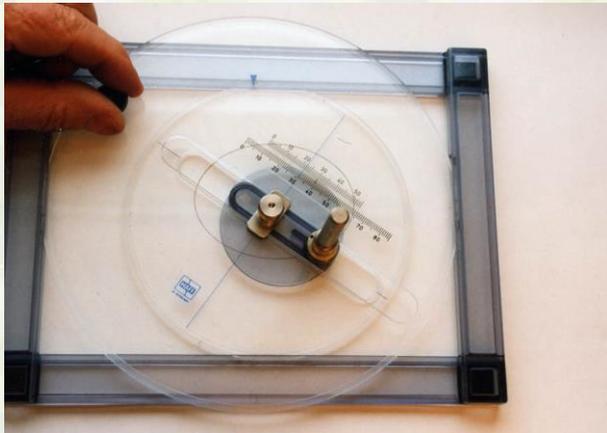


Figure 2105
Drawing-Ellipsograph
(Gebrüder Haff GmbH,
D 87459 Pfronten)

The ellipsograph in Figure 2106 draws and cuts ellipses to the side of the mechanism. This allows the smallest ellipses to be drawn. The mechanism corresponds with a patent by F. O. Kopp. Instructions for its use have been published [[1.2.8](#)].

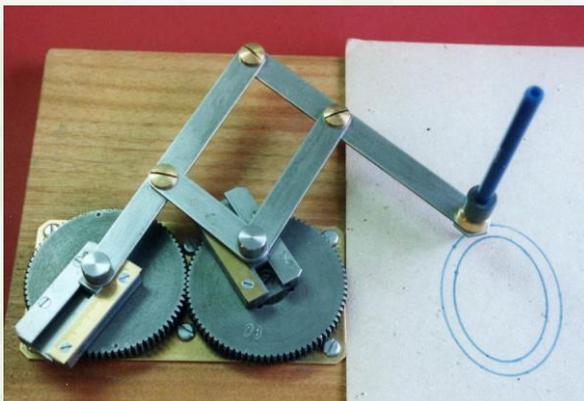
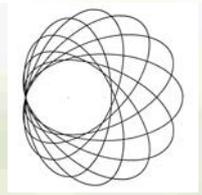


Figure 2106 Kopp-Ellipsograph
(Workshop J. Volmer, Chemnitz 1999)



4 Oval Chuck and Ovalturning Lathes

4.1 Review

Obviously the first not perfectly circular pieces were turned in the renaissance on lathes with the spindles controlled by cam discs both in radial and in axial directions. There are drawings in ancient books, such as in figure 3101, although the lathes in this drawing do not seem to fit with mechanical engineering laws.

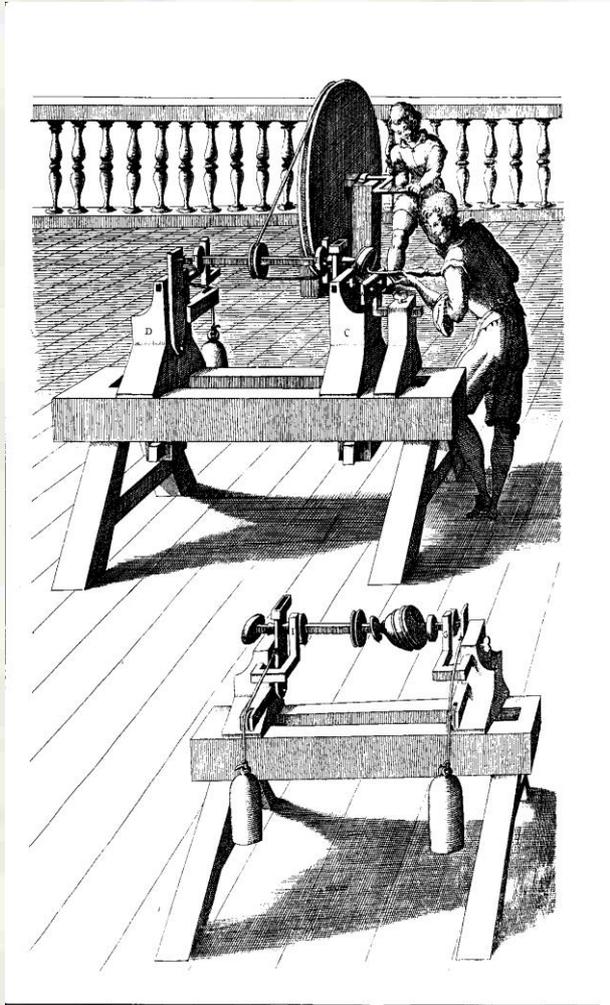


Figure 3101 Lathe for Ovalturning by Salomon de Caus: Von gewaltsamen Bewegungen (About violent movements). Frankfurt 1615

Later on the principle of cam controlled movement was applied to Rose-Engines on which, by means of corresponding cam discs, rosettes and other complicated profiles may be turned. This is the base for Artistic Turnery (Kunstdrechselei) and for Ornamental Turning. The Societies of Ornamental Turning in England and in the USA are still in action [5.11]. Occasionally oval pieces using the classic oval chuck but as rotating cutters or routers are used to shape the pieces then this is to be considered an ovalmilling process.

In England, the Alsatian, Charles Holtzapffel designed and built turning lathes for the nobility. Such a Holtzapffel lathe – built in 1865 - was given in 1886 by Queen Victoria to the Archduke Otto von Habsburg as a wedding gift. It remained unchanged, with the complete numerous accessories complete, in Vienna . Its oval chuck is shown in figure 3102. Holtzapffel has described its operation in the 5th volume [1.2.1] of his great book.

4 Oval Chuck and Ovalturning Lathes

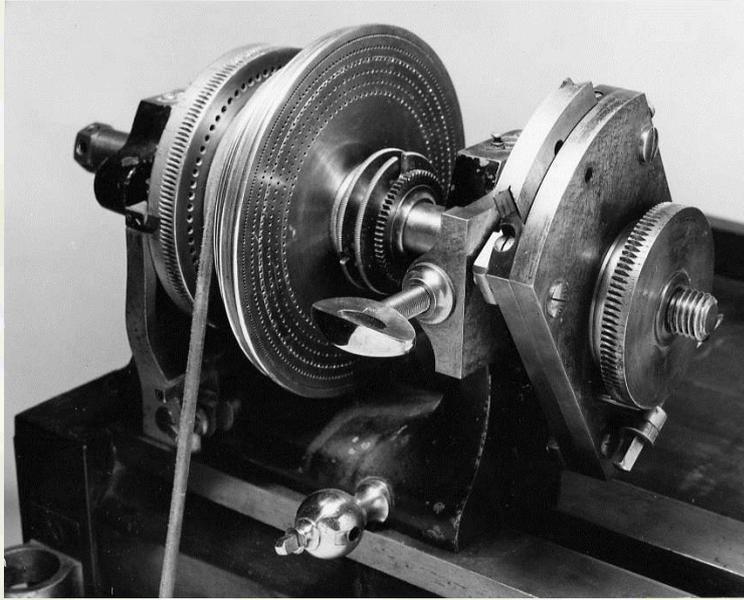
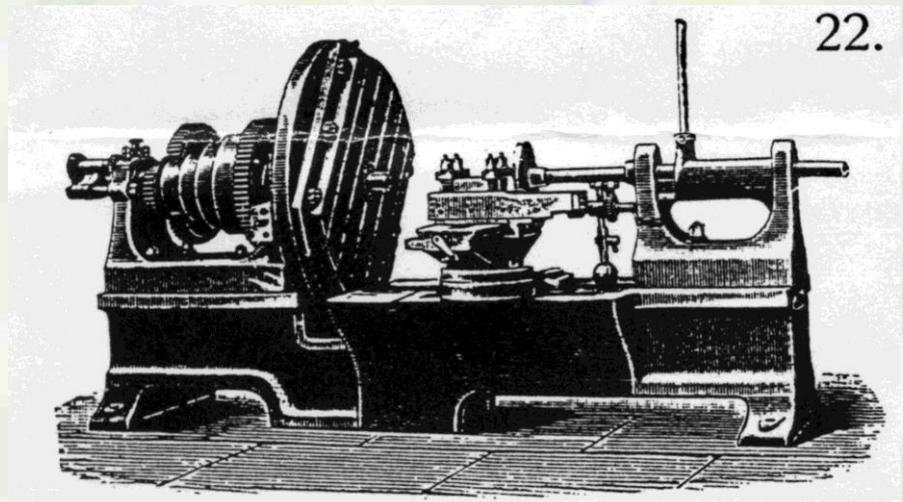


Figure 3102 Oval Chuck of the Holtzapffel Lathe of Otto von Habsburg, Vienna 1886 [\[1.1.3\]](#)

Figure 3103
Heavy metal spinning lathe for oval bowls, pans and the like.
(Erdmann Kircheis,
Aue/Saxony)



In Germany oval chucks (Ovalwerke) of the classic type were produced until 1950. These oval chucks were screwed onto the lathe as an additional device. There were also ovalturning lathes on the market built as single purpose machines. The principle of the classic oval chuck was also used on machines to form shallow oval bowls and plates from porcelain clay mass and also for spinning oval pieces on spinning lathes (Figure 3103).

There are numerous patents describing improvements to the classic oval chuck. The aim of the majority of these inventions was to avoid the sliding joints and their lubrication, to compensate for the lack of balance and to achieve a smoother run. These improvements have been achieved by J.Volmer with his ovalturning lathes ODM [\[2.2.6\]](#). Using the Volmer ellipse mechanism the lathe producer VICMARC/Australia [\[5.1\]](#) [\[5.2\]](#) offer the VICMARC Ovalturning Device (VOD) that can be adapted to every woodturning lathe of a suitable size. Dan Bollinger/USA [\[5.3\]](#) built the ovalturning lathe BOTULA using a variant of the Volmer ellipse mechanism ([see figure 3401](#)). Other enthusiasts followed him with their shop made ovalturning devices. The German woodturning craft supply [Steinert®](#) [\[5.4\]](#) presented in 2006 the small ovalturning lathe [picOval](#).

4.2 Ovalturning on the Rose Engine

A Rose Engine (in German Querpassig-Drehbank) has a rocking headstock and an elliptical cam disc, for ovalturning, on the spindle as shown in figure 3201. The cam is held in permanent contact with a roller in the lathe frame by means of a spring.

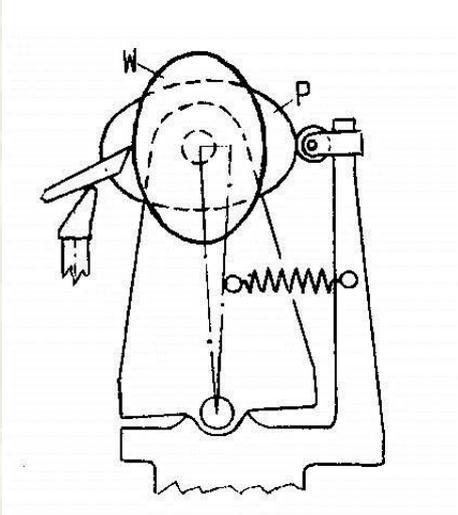


Figure 3201 Rose engine headstock with oval cam disk
P Cam (Patrone), W Workpiece

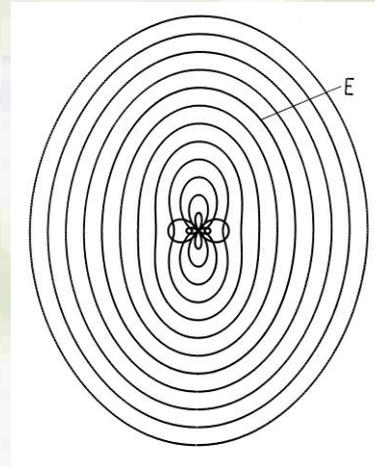


Figure 3202
Curves by an elliptical cam disk E

Few of these lathes are in use today. They can only be operated at low speed and have been used since the 16th century for the ivory turning. Looking at antique pieces, as in the Ivory Collection in the Green Vault in Dresden [1.1.5], one can recognize the oval forms visibly differing from the ellipse. Figure 3202 shows the curves which the tool cuts on the workpiece, if an elliptical cam disk is used. The curves in the middle have nodes.

4.3 The Classic Oval Chuck (Ovalwerk)

The invention of the classic oval chuck is ascribed to Leonardo to Vinci (1452 - 1519), however there is still not absolute proof even though Leonardo has left numerous drawings. This chuck is based on the kinematic inversion of the double slider, the trammel. Figure 3301 shows the kinematic scheme and figure 3302 its constructive parts. Parts with the same number in the two figures correspond. Parts of same colour are firmly connected to each other.

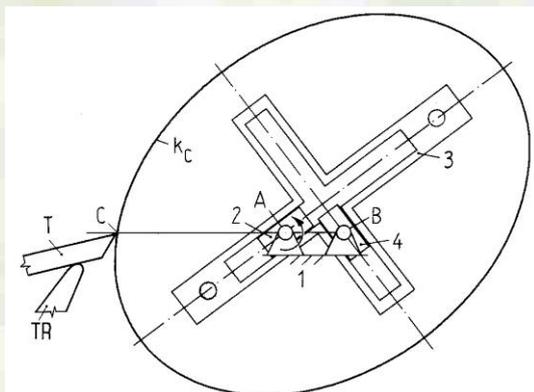


Figure 3301 Kinematic scheme of the oval chuck mechanism
[5.5]

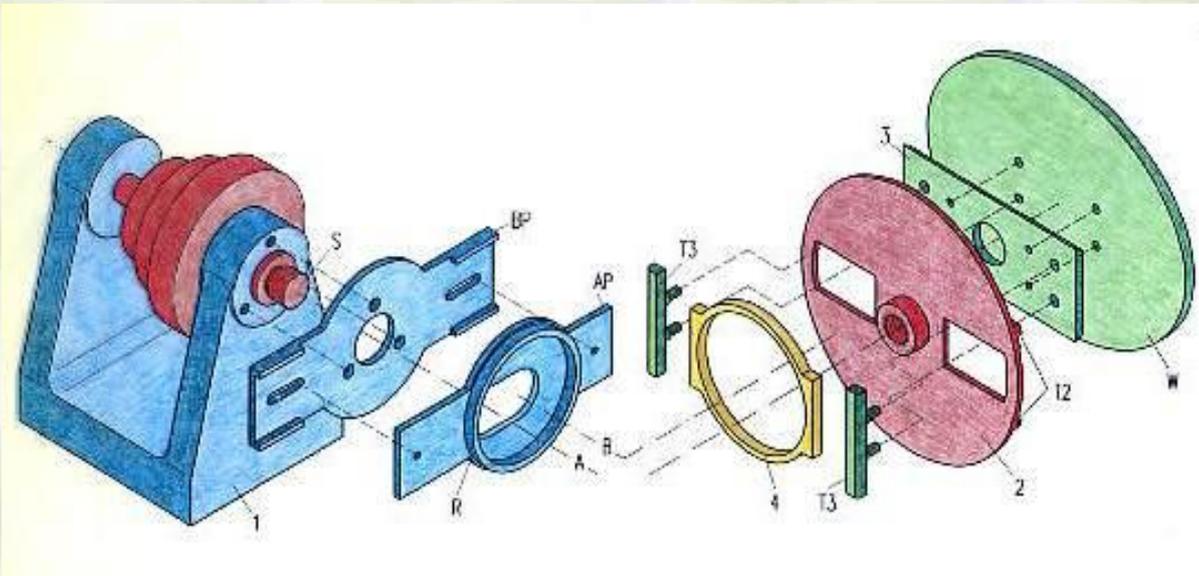


Figure 3302 Details of the classic oval chuck (Explosion drawing)

In the headstock 1, the driven spindle runs in bearings. Centre plate 2 is screwed onto the spindle head S and is provided with dove-tailed tracks T2 for slider 3, on which the workpiece W is to be mounted either directly or by means of the faceplate or a work-holding device. Slider 3 has another pair of tracks, T3, keyed to adequate tracks on the collar plate 4 that fits over and moves around the ring R. This ring is integral with the adjuster plate AP, and this is located between parallel bars on the backplate BP, which in turn is fixed directly to the headstock 1. The ring plate R is adjustable from the spindle centre A to the position B, so giving the offset needed to make an ellipse. The distance AB is equal to the difference d of the ellipse half-axes. Further design details are given in [\[2.2.6\]](#).

Oval chucks of this design were manufactured in different sizes by many lathe producers in Europe. Figure 3303 shows an oval chuck made by the German company Alexander Geiger in Ludwigshafen. It is in the possession of Mike Darlow in Australia [\[1.2.9\]](#).

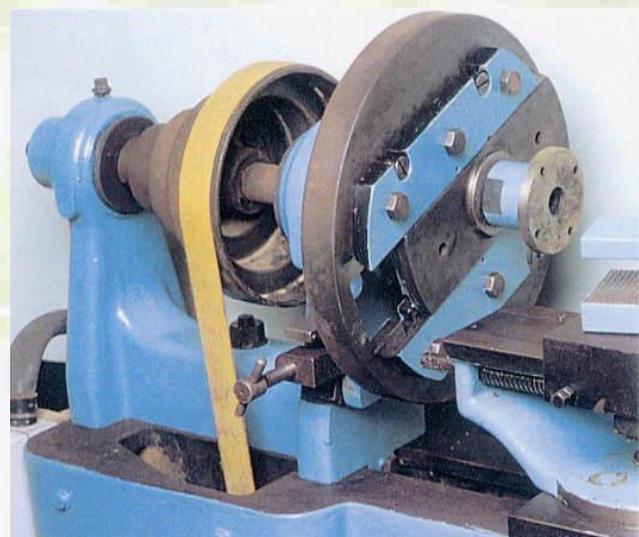


Figure 3303
Oval chuck made by Alexander Geiger,
Ludwigshafen, about 1930, in possession of
Mike Darlow, Australia [\[1.2.9\]](#)

4 Oval Chuck and Ovalturning Lathes

In some German woodturner workshops [5.9] and in woodturning schools [5.6] [5.7] [5.8] oval chucks of this type can still be found, but they are rarely used. They remind one of an once very actively applied approach to very challenging woodturning techniques.

There were also single purpose ovalturning lathes on the market. Headstock and oval chuck formed a single unit. As single-purpose-machines they had great advantages in comparison to the oval chuck as an accessory. They often had solid foundations to absorb the unbalanced forces which resulted from the ellipse motion.

Many endeavours were dedicated to the compensation of these unbalanced forces in order to achieve a smooth run of the lathe and to reduce their effect on the ovalturner. There were many different inventions which dealt with this problem. The German company Alexander Geiger found practical solutions to this problem. In 1909 Pryibil, an American company, used a theoretically exact solution to build an ovalturning lathe which overcame the out-of-balance problem. These ovalturning and oval spinning lathes were equipped with a brilliant but very complicated mechanism, even adjustable whilst the lathe was running (figure 3304). Unfortunately none of these machines has survived.

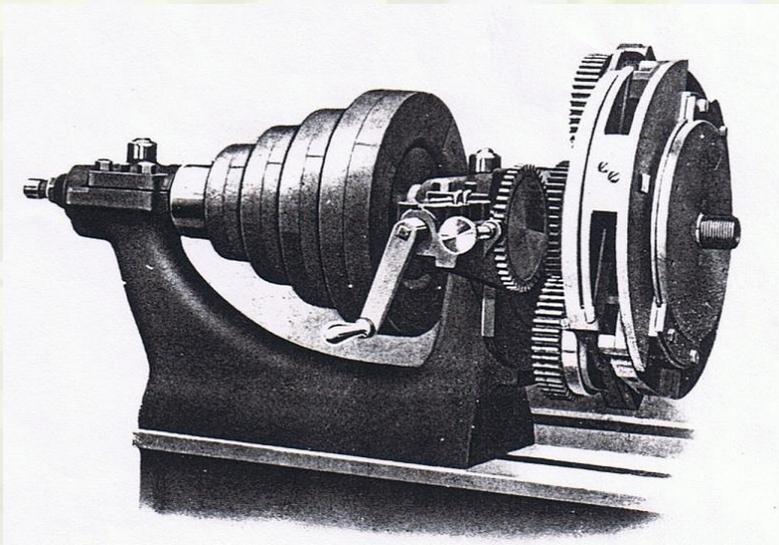


Figure 3304
Ovalturning lathe with inertial force
balancing, adjustable while
running
(Company P. Pryibil, New York
1909)

A mechanism analysis [2.1.2] of the classic oval chuck has shown that the unbalance compensation problem can be solved very simply (figure 3305). We may assume that the centre of gravity of the mass m of the elliptical workpiece, including the work-holding devices, is located on the midpoint M of the ellipse. The point M runs - as the ellipse motion in figure 1101 is showing - along the circle k with the radius $r = (a - b)/2$. A constant centrifugal force F arises from this and can be compensated by the diametrical centrifugal force F_C of a compensating mass m_C in the distance r_C from the spindle centre M_0 . The relation $m_C r_C = m r$ is valid. The compensating mass m_C rotates around the spindle centre M_0 with double the revolutions per minute of the workpiece.

4 Oval Chuck and Ovalturning Lathes

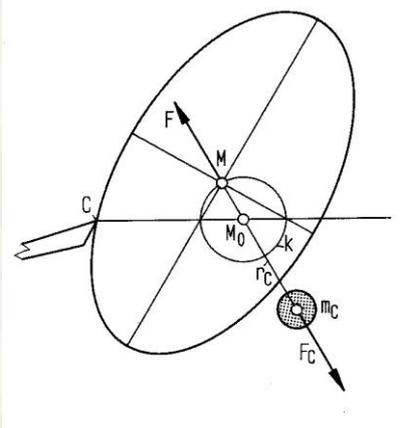


Figure 3305 Inertial forces of the ellipse motion of the classic oval chuck

An Ovalturning Device with unbalance compensation has been designed by J. Volmer, and in 1983 built in Olbernhau in the Ore Mountains (Erzgebirge). He has tested it, improved and variously used (figure 3306) [\[2.1.1\]](#).

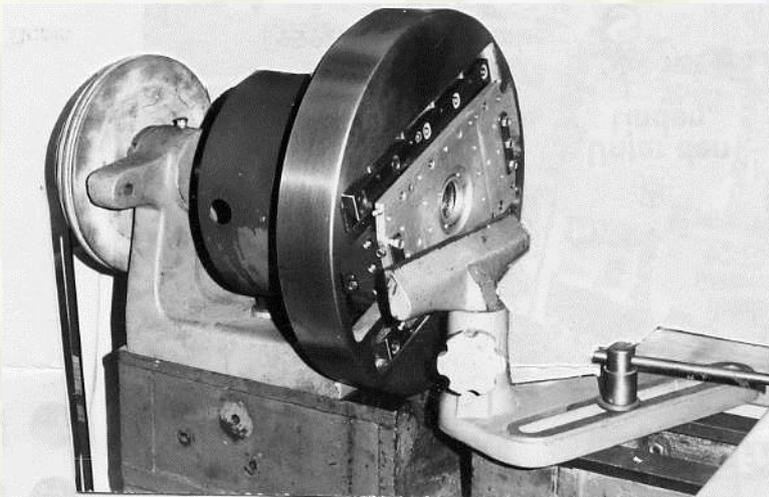


Figure 3306
Ovalturning Device (ODV) with unbalance compensation
(VEB Olbernhauer Maschinenfabrik, Olbernhau Ore Mountains 1983)

4.4 Ovalturning Lathes (ODM)

The Volmer-Ovalturning-Lathes (ODM) generate the ellipse motion ([figure 1101](#)) by means of a special ellipse mechanism of the following construction ([figure 3401](#)).

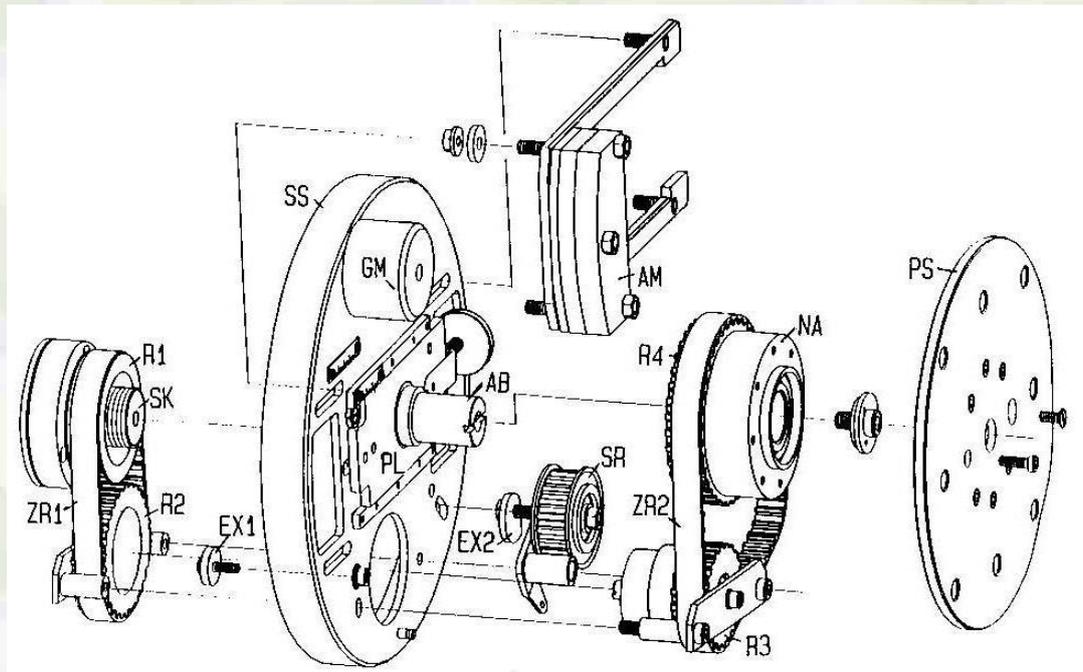


Figure 3401
The ellipse mechanism of the Ovalturning Lathe [ODM30](#)

On the head SK of the driven spindle is screwed the main plate SS. On this the plate PL is adjustable mounted. The offset of plate PL is adjustable within the range of 0 to a maximum of 30 mm. This is the distance between the stub axle AB and the spindle axis, and it is related to the quarter of the axes' difference of the ellipse to be turned. On axle AB rotates the toothed belt wheel R4 with its hub NA. Onto NA are screwed either the faceplate PS or flanges of work-holding device. Wheel R4 is driven via tooth belt ZA2 by wheel R3 which is on one shaft together with wheel R2, and this is driven via tooth belt ZR1 by wheel R1 that is fixed to the headstock. For two revolutions of the main plate SS the faceplate PS turns one revolution. Tooth belt ZR1 is tensed by eccentric disc EX1, and tooth belt ZR2 by the idler pulley SR and eccentric disc EX2. The mass GM balances the masses of the wheels R2, R3 and pulley SR. The counterweight AM is dimensioned and positioned according to the position and mass of plate PL and parts on it including the workpiece and work-holding devices. The precise mass of the latter must be known. The turner can read these counterweight parameters from diagrams, calculations are not necessary.

Two prototypes have been built: The Ovalturning Lathe ODM15 (figure 3402) for a maximum ellipse axes difference (sway) of 60mm, and the bigger ODM30 (figure 3403) for 120mm. The [VICMARC](#) Ovalturning Device (VOD) has the size of the ODM30, in figure 3404 it can be seen screwed on a [WEMA](#)-headstock [5.12].

4 Oval Chuck and Ovalturning Lathes

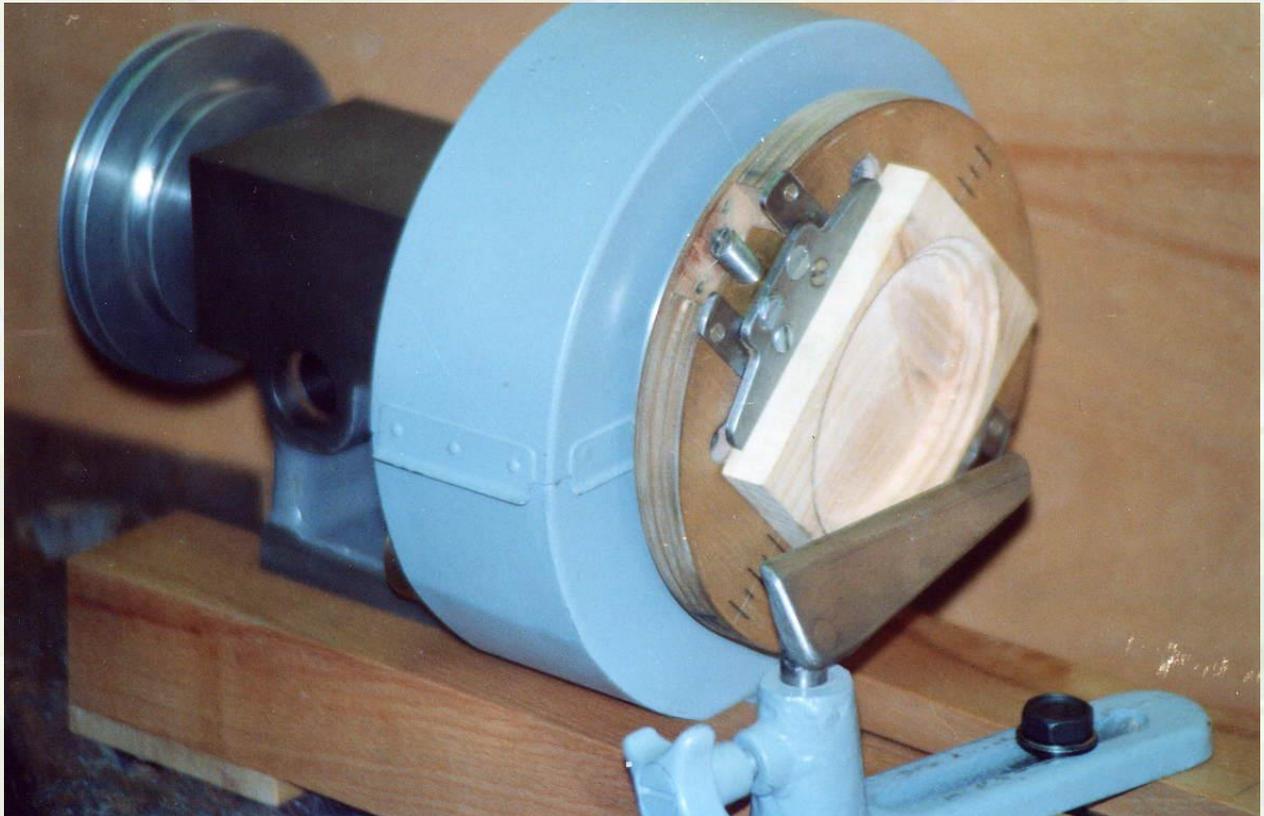


Figure 3402 Ovalturning Lathe (Ovaldrehmaschine) ODM15
(Workshop J. Volmer, Chemnitz 1989, photo Günther Göthl)



Figure 3403 Ovalturning Lathe ODM30
(Workshop J. Volmer, Chemnitz 1993)

4 Oval Chuck and Ovalturning Lathes

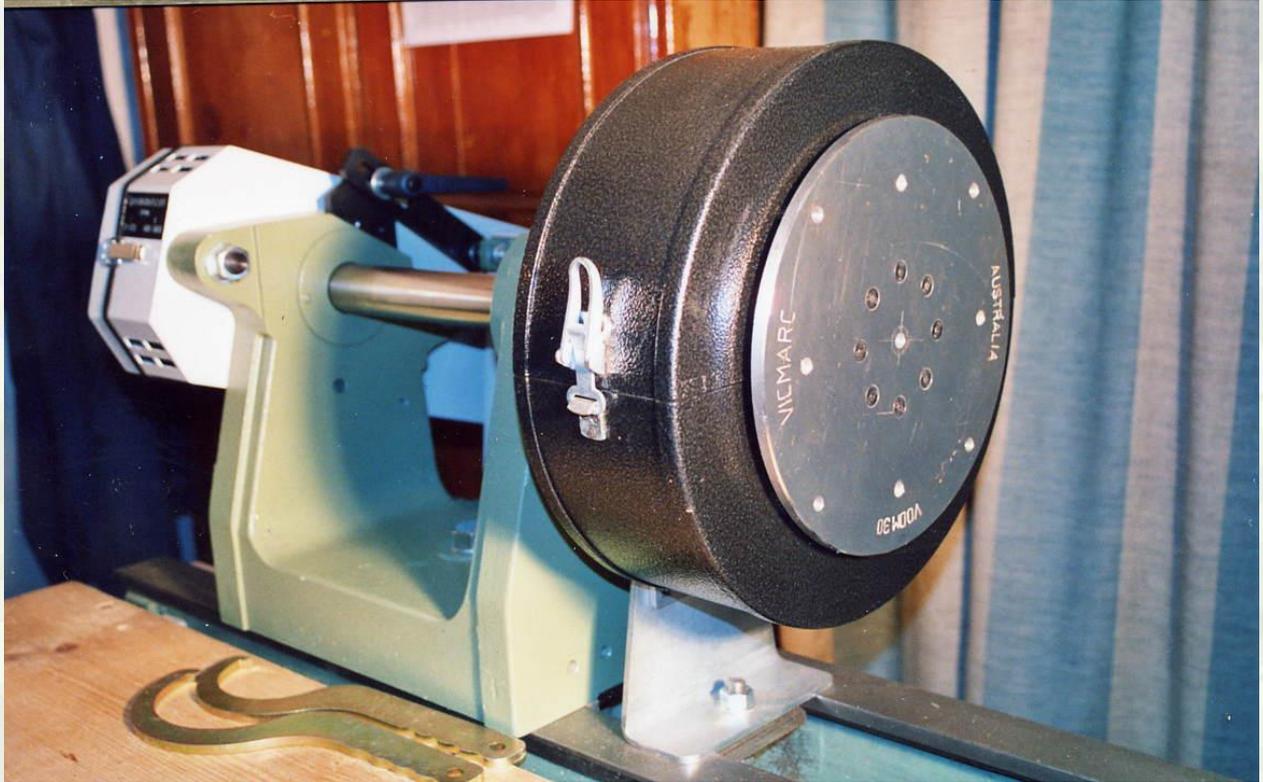


Figure 3404
VICMARC Ovalturning Device (VOD) ([VICMARC Machinery Australia 2000 \[5.1\]](#).)
at WEMA Headstock GAMMA ([WEMA Olbernhau \[5.12\]](#)), (Workshop J. Volmer 2000)



Dan [Bollinger](#), USA, has built a complete Ovalturning Lathe with a variant of the Volmer ellipse mechanism. Its maximum ellipse axes difference (sway) is very large. Other ovalturning devices using the Volmer Ellipse-Mechanism known to the author are shop-made by Buddy Lawson (Republic of South Africa), John Morgan (Australia) and Frank Freude (Germany).

Figure 3405 Bollinger Ovalturning Lathe (BOTULA) [\[5.3\]](#)

4 Oval Chuck and Ovalturning Lathes

The small ovalturning lathe picOval (Figure 3406) was introduced in March 2006 by Drechselzentrum Erzgebirge Steinert® [5.4]. The maximum ellipse axes difference (sway) is 80mm. The lathe headstock is also offered without motor and belt drive (Figure3407). It can be mounted on any woodturning lathe bed of suitable size and connected via a Cardan-shaft and an adapter with the lathe-spindle [2.2.19].



Figure 3406
Ovalturning lathe picOval (Drechselzentrum Erzgebirge [Steinert®](#), 2006 [5.4])



Figure 3407 Headstock of the Steinert® ovalturning lathe picOval without motor and belt drive mountable on suitable lathe beds via an adapter [2.2.19][5.4]

5. Work-Holding

5.1 General Conditions

For chucking blanks, and pieces completely oval turned at one side, onto the ovalturning lathe there is a variety of holding and chucking devices, among them chucks which are used for normal (circular) turning. But, take note, the screw chuck used for holding circular facework is strictly forbidden when oval turning as it does not hold the blank safely in its position. The blank can twist, and this is extremely dangerous. Any movement of the workpiece from its starting position must be absolutely avoided.

When circular turning one can rotate the workpiece within loose chuck jaws, with an oval workpiece this is not possible. The workpiece must remain in the chuck in the same position from the very beginning. The new ovalturning lathes allow the chucked workpiece to be rotated together with the chuck or the faceplate.

Work-holding devices should be as light as possible due to the unbalance forces when ovalturning. Wooden parts are preferred. One should choose the lightest types of steel chucks.

The workpiece should be held as close to the faceplate as possible. Overhanging workpieces cause vibrations and consequently no cleanly cut surfaces.

5.2 Screwing on

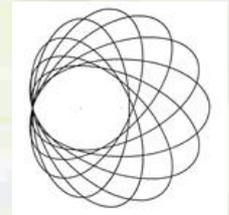
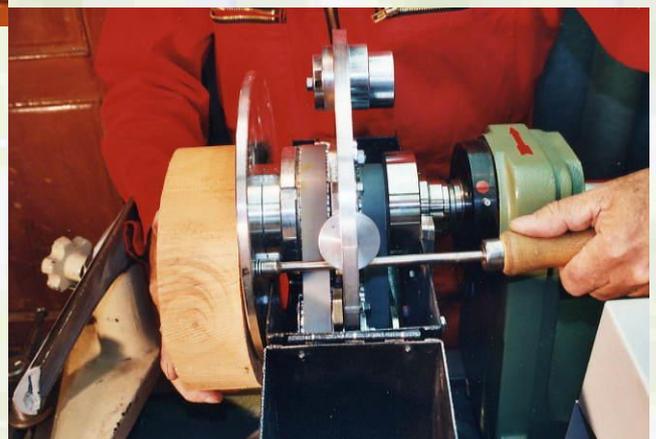


Figure 4201

The faceplate of the Ovalturning Lathe ODM30 has a series of through holes and M8 thread holes for screwing workpieces and work-holding devices to faceplate

Figure 4202

A cut oval blank – for instance for bowl turning – can be screwed directly onto the faceplate from the rear using strong hexagon headed wood screws.



5 Work-Holding

Figure 4203

To protect the faceplate a cardboard disc is placed between it and the workpiece allowing cuts to be made up to the rim of the bowl.

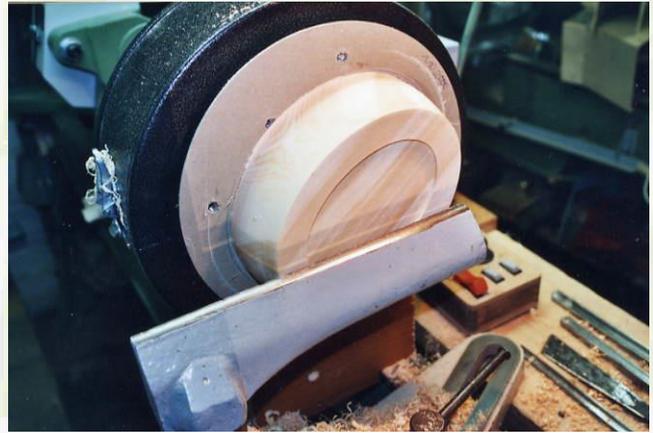


Figure 4204

Hardwood discs for recesses or spigots are likewise screwed from the rear onto the faceplate.

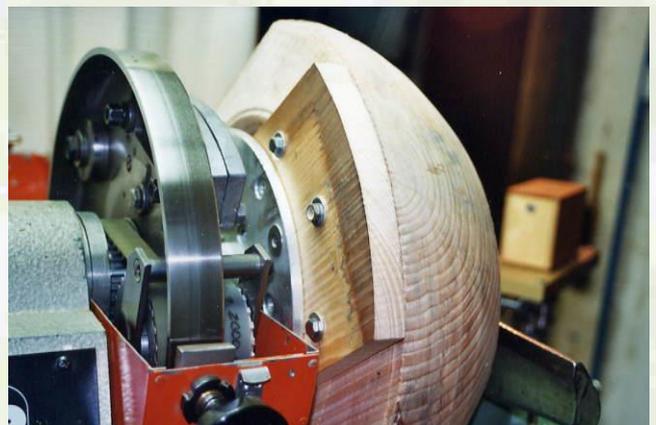


Figure 4205

The shallow ebony bowl, with the outside completed, is jam fitted into a recess in a hardwood disc screwed onto the faceplate. Note the slots for levering the bowl out after ovalturning and sanding the inside.

Figure 4206

For workpieces hanging over the faceplate a board is screwed onto the faceplate using M8 countersunk screws. The workpiece is fixed onto the board from the rear using hexagon head woodscrews.



5 Work-Holding

Figure 4207

Flat light blanks to be turned completely only from the front, as with shallow bowls, are glued with paper onto a board which is then screwed from the rear onto the faceplate.



5.3 Chucks

Figure 4301

The claw chuck consists of a hard plywood board about 27mm thick and 4 claws made from 2mm steel sheet. Their prongs are hammered into the blank. The claws are screwed onto the board using M6 screws. On the rear of the board there are in-line holes with captive nuts beneath. (Workshop J. Volmer)

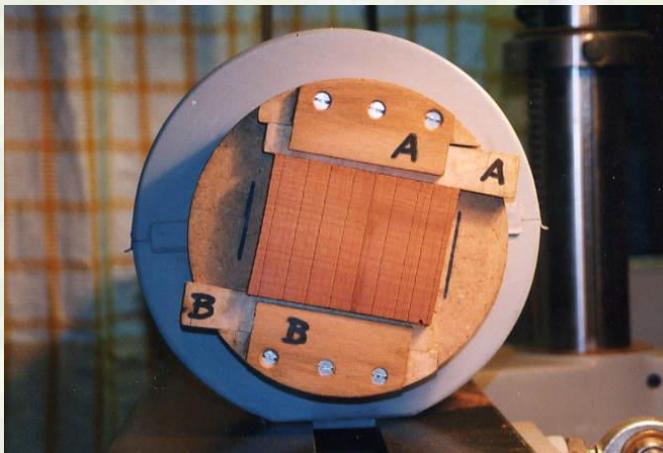


Figure 4302

The wedge chuck is used for workpieces with parallel edges, e.g. rectangular picture frames. It is simple to build, but has a small chucking range. Wedge chuck for the Ovalturning Lathe ODM15. (Workshop J. Volmer).

5 Work-Holding

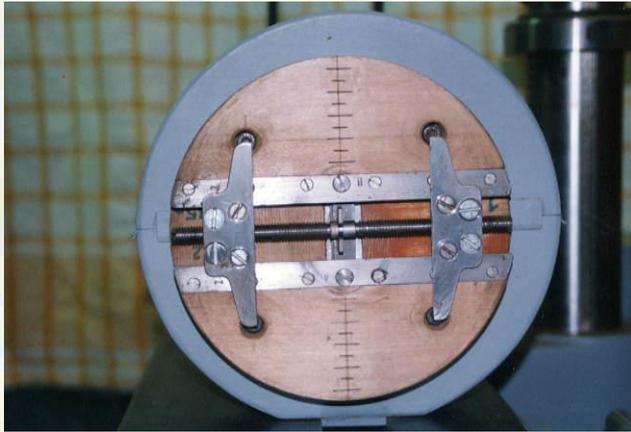


Figure 4303

Two-jaw chuck for workpieces with parallel edges, screwed on the faceplate of the ODM15. Chucking range 9mm to 102mm, plywood body, mass 0,39 kg (Workshop J. Volmer).

Figure 4304

Two-jaw chuck for workpieces with parallel edges, screwed on the faceplate of the ODM30. Chucking range 94mm to 240mm, plywood body, mass 1,5 kg (Workshop J. Volmer).

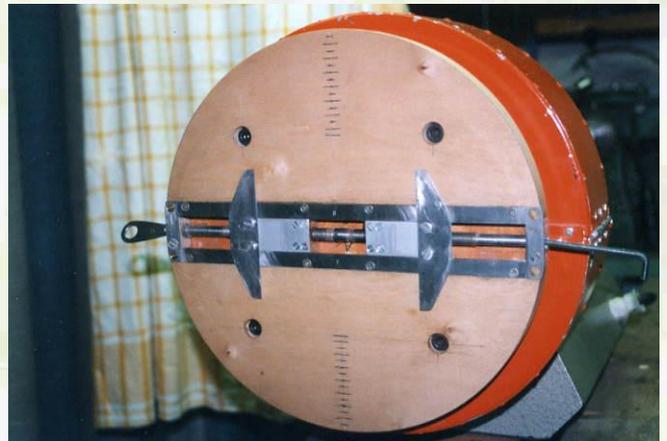


Figure 4305

Two-jaw chuck with 4 sharp-edged screw heads for chucking internally or externally oval turned pieces, e.g. bowls.

Figure 4306

VICMARC Four-Jaw-Chuck VM90 screwed on a short flange (instead of the faceplate) of the ODM30, with two sets of jaws fitting circular grooves in oval sawed blanks

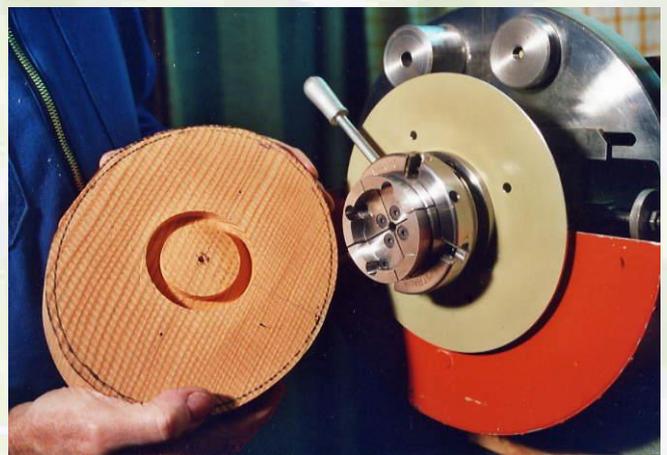


Figure 4307

Drills, made of steel sheet, for drilling circular grooves fitting the steel jaws SC45 and SC67 of the VICMARC Four-Jaw-Chuck VM90 (Workshop J. Volmer)

5 Work-Holding

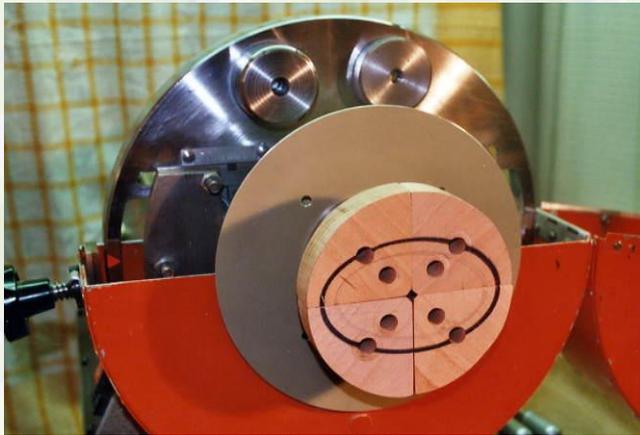


Figure 4308

VICMARC Four-Jaw-Chuck VM90 with hardwood jaws, screwed on by deep-set countersunk-head screws, jaws pressed together for turning an elliptical spigot fitting the recess of the workpiece. Best chucking is if the ellipse axes coincide with the jaw edges.

Figure 4309

VICMARC Four-Jaw-Chuck VM90 with hardwood jaws, pressed together with wooden spacers for turning an elliptical recess fitting the spigot of the workpiece. The ellipse axes coincide with the jaw edges

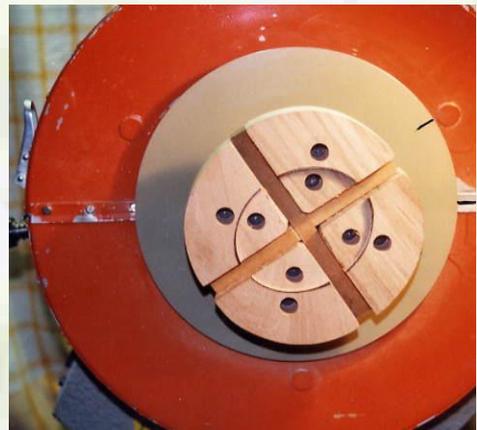


Figure 4310

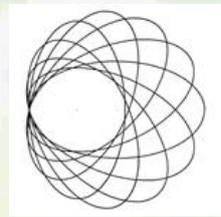
Small bowl with spigot, outside shape turned, chucked by the hardwood jaws for ovalturning the inside



Figure 4311

Screw chuck with ring of prongs as anti-twist device for ovalturning long grain pieces using the tailstock ([ELLPIN](#)) (Workshop J. Volmer)





6 Methods of Ovalturning

6.1 Guiding the tool

The essential differences between ovalturning and normal (circular) turning are the ellipse motion of the workpiece and the complicated tool guiding resulting from this motion. The cut should always be carried out in the central plane or lengthwise along the central line. When circular turning it does not matter whether the position of the cutting edge of the tool is above or below centre height as circles are always produced concentric to the spindle axis. When ovalturning the position of the cutting edge plays an essential roll.

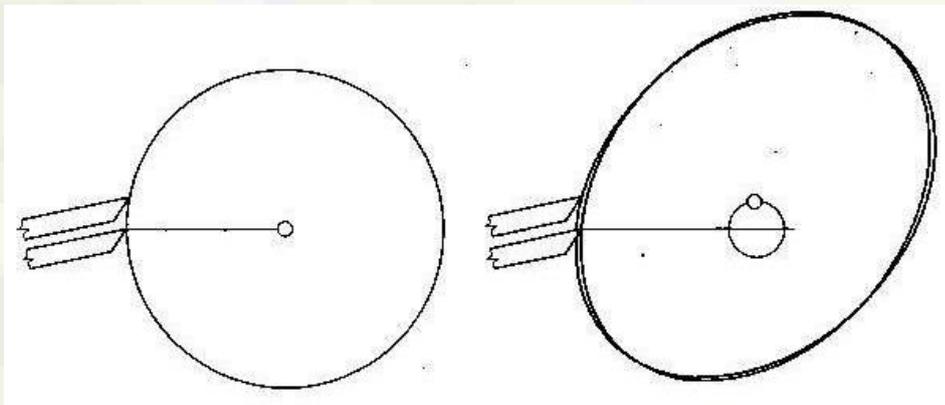


Figure 5101 Result of tool positions at the circular cylinder and at an elliptical cylindrical workpiece

Figure 5101 right shows an ellipse cut by the centrally positioned edge and an ellipse cut by an edge positioned above the central line. The two ellipses penetrate each other. This means that the ellipse cut centrally is penetrated by the ellipse cut more highly. Two facing grooves arise in the surface. If such grooves appear at the cylindrical area of the oval turned workpiece, this shows that the tool edge was not guided centrally. Only by guiding the edge centrally can one achieve a clean surface. The tool should cut, theoretically, with a point of its edge in order to obtain an exact ellipse but this is practically impossible. Therefore the ovalturner uses pointed gouges. Scrapers, as they may be held horizontally at a precise height and position, enable the turner to always cut on a central line.

6.2 Lightline

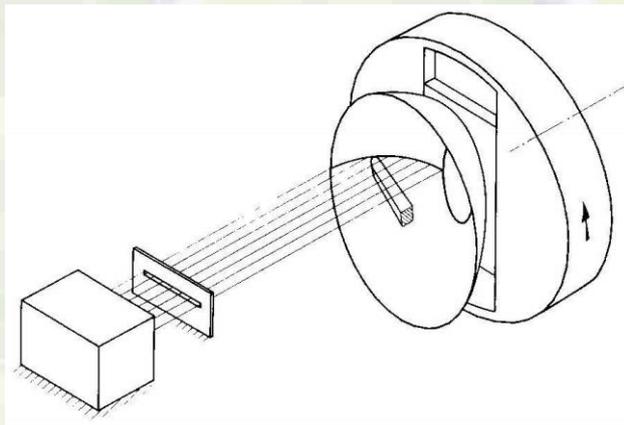


Figure 5102
Scheme of the Lightline-Projection

In order to make the central line visible at the workpiece and to guide the cutting edge exactly along this line J. Volmer uses a lightline. It is generated using a projector with a special slide or using a laser. When the workpiece is rotating, the line will remain static allowing the tool to follow this correct path. An added important benefit is that this

6 Methods of Ovalturning

lightline clearly shows the turned profile as work progresses. The projector generates a lightplane, and is positioned so that the lightplane coincides with the central plane. A template is used to adjust the projector on its stand. It is placed on the lathe bed in front of the workpiece and has a marked horizontal line at centre height with which the projected lightline must coincide (see figure [5504](#)).



Figure 5103

Application of the lightline when turning the inside of an oval bowl. The projector is on a stand, about 1.5 m in front on right side, separate of the ovalturning lathe ODM30.

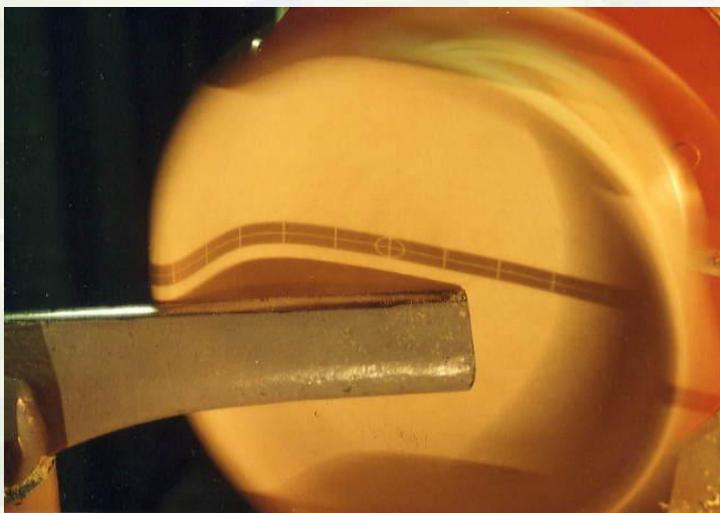


Figure 5104

The lightline makes the internal profile of the finished bowl visible, it is standing still in spite of the bowl's running.

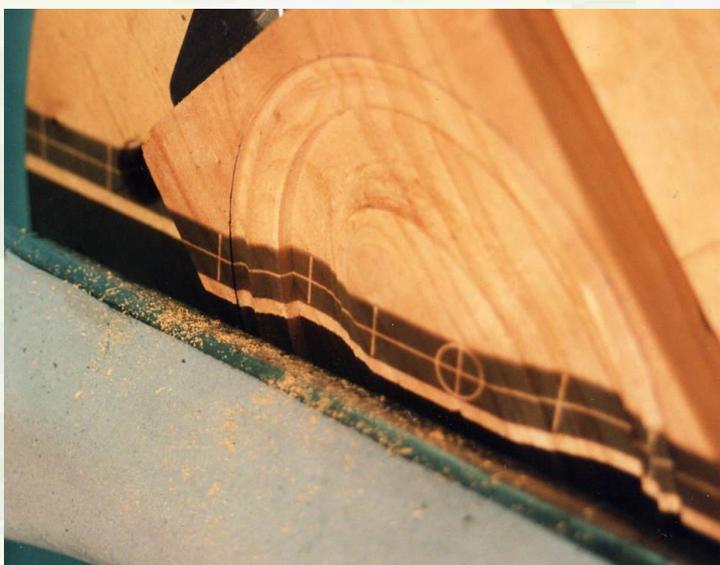


Figure 5105

The lightline shows the fine profile of a frame (here a rectangular frame) exactly visible while the workpiece is rotating. The tool has cut along the projected lightline.

6.3 Ovalturning Tools

The ovalturning tools are free hand guided gouges and scrapers and, in some cases, chisels. The gouges are ground to a lady-finger shape in order to have a short cutting area at the edge. The side parts of those edges are used for straight surfaces. The wedge angle depends on the type of wood to be cut. Scrapers have different edge profiles, e.g. straight edges for recesses and round for inside profiles of deep and shallow bowls.



Figure 5201
Ovalturning tools

For hard materials, like bone, ivory, horn and soft stones, one uses turning tools formed for non-ferrous metals. Those tools are fixed in a compound slide rest and fed into the workpiece slowly. Figure 5202 shows, as an example, ovalturning napkins rings from cattle bone.



Figure 5202

Ovalturning rings of bone at the ODM15 with the tool in the compound slide rest

When ovalturning a series of identical workpieces special devices are helpful to ensure uniformity. For this purpose the Piercer (Stecher) was designed following the example of the Bankfraeser, common in the Ore Mountains (Erzgebirge). The piercer is used, for instance, to produce exactly the same diameter of the recess in all the frames of a series. The piercer consists of a swivelling arm, also movable in direction of the spindle axis. Upon the arm is fastened at a certain position a narrow pointed gouge. The arm lies on the tool rest or with an adjustable stopper on the lathe bed. The axis direction is also limited by an adjustable stop.

6 Methods of Ovalturning

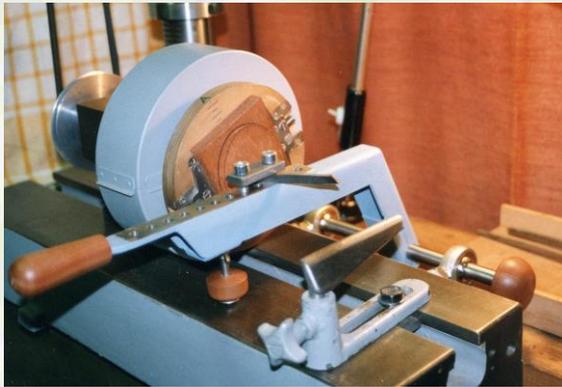


Figure 5203
Piercer at the ovalturning lathe ODM15 with its arm in working position

Figure 5204
Marking the recess edge at a small rectangle picture frame using the piercer. The small pointed gouge is fastened upright and stings exactly on the central line.

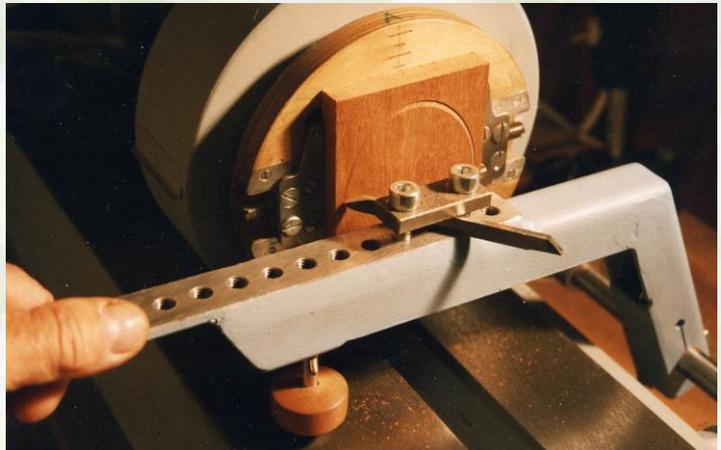


Figure 5205

After roughly turning the recess using hand-held tools, to within one or two millimeters of the required size. Using the piercer the recess wall is now neatly cut

6.4 Ovalmilling

At the ovalturning lathes if rotating profile knives or routers are used, instead of hand-held woodturning tools, then Parallel Curves of the ellipse are cut. These curves are not ellipses. Woodturners who make workpieces in this way at the oval chuck, because it is an easier method of production, are often surprised with the results. The curves obtained by milling can visibly differ from that of the ellipse, they can even have cusps (figures 5206 and 5207).



Figure 5206
Routing-Motor with chucked Two-Knife-Ball-Cutter, fixed in a compound slide rest, milling the underside of a bowl at the Bollinger Ovalturning Lathe (BOTULA) [5.3]

6 Methods of Ovalturning

Figure 5207
Milling the bowl underside [5.3]



The oval chuck or the ellipses mechanism of the ovalturning lathe guides the router-axis C relatively to the workpiece on the ellipse e (figure 5208a). A cylindrical router with radius r cuts the outer curve q_0 and the inner curve q_i into the face of the workpiece. Both curves have the distance r to the ellipse e . They are called Equidistant or Parallel Curves. While q_0 is similar with the ellipse e the inner parallel curve q_i shows visible deviations of the ellipse e . For small axes ratios q_i has a cusp (figure 5208b), and for a smaller ratio arises undercut (figure 5208c). The mathematical relation for that is $r/b \Rightarrow b/a$.

The Parallel Curves of the ellipse have been investigated in the 19th century, e.g. by the renown British mathematician Arthur Cayley (1821 - 1895). They are algebraic curves of eighth order and called Toroides.

On oval bowls or plates the effects of ovalmilling, mentioned above, may not be visually disturbing. Problems may occur when fitting two oval milled parts, e.g. when matching a lid with its box. In figure 5209 the router is guided for cutting the outer contour q_1 of the box along the ellipse e_1 , for cutting the inner contour q_2 in the lid along the ellipse e_2 . Both ellipses have the same axes difference, i.e. both contours are milled with the same adjustment of the oval chuck

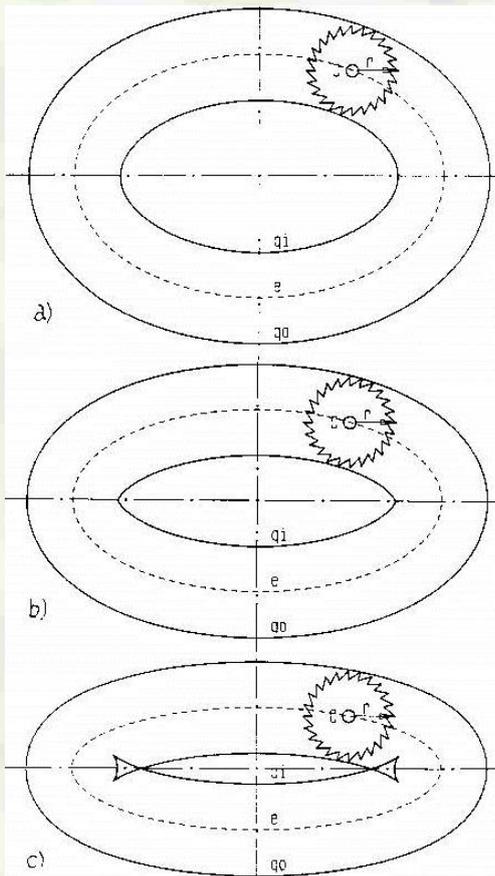


Figure 5208
Parallel curves q_i and q_0 of ellipse e with different axes ratios b/a and router-radius-ratio r/b
a) $b/a = 0,67$ $r/b = 0,38$
b) $b/a = 0,50$ $r/b = 0,50$ (cusp at q_i)
c) $b/a = 0,33$ $r/b = 0,75$ (undercut)

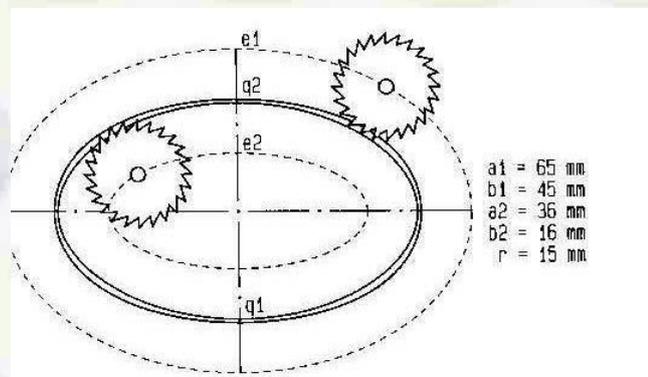


Figure 5209
Ovalmilling of outer and inner contour with same adjustment of the oval chuck

6.5 Ovalturning of Facework (Cross Grain)

Oval bowls, plates, platters, frames and many more of the oval objects mentioned in the list of oval turned items for use in general are turned as facework, i.e. of cross grain blanks. In ovalturning the flatter the object the more simple is the turning process. Ovalturning of deep objects, bowls or vases for instance, is more complicated. In the old literature there is no description of the way tool are used to produce the cleanest cuts and smoothest surfaces. Using scrapers, shavings can easily be made but producing a smooth surface on wooden pieces is not so easy. Spannagel, the author of the German woodturner bible „Das Drechslerwerk“, published in 1940 [1.1.2], wrote, in the chapter Ovalturning, that the only way to get acquainted with the practice of ovalturning, especially handling the tools, is to watch an efficient and competent master. Unfortunately such a master is not to be found easily today. On the other hand, the masters hardly understood the geometric relations because any books of the time presented, at the most, a scant outline showing that the tool has to cut in spindle height. Scrapers have, historically, been used in preference to gouges. It is easier to lay scrapers on a plane tool rest enabling it to be kept at centre height.

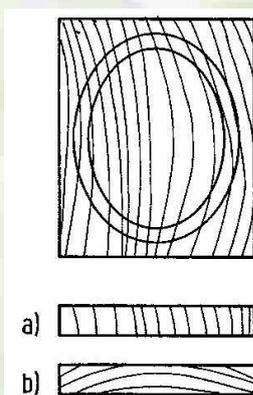
6.6 Ovalturning of Frames

The first book that was dedicated exclusively to ovalturning of frames was the German "Handbuch der Ovaldreherei" (Manual of Ovalturning) [1.1.1]. It was written in 1920 by Hugo Knoppe, meritorious teacher at the Technical College for Turners, Carvers and Sculptors in Leipzig / Saxony.

Oval frames were produced in large quantities in frame-making factories. The frame blanks were made up of 4 or 6 parts. Each factory had its own technique for joining the frame blank parts, predominant were mortise and tenon joints as seen preserved in the oval frame factory, The Old Schwamb Mill in the USA [5.10] [2.2.11][2.2.12]. In Germany there was a factory that offered horseshoe-like bent wood arcs. The arcs were glued together using a scarf joint. These frame blanks had the advantage that the fibres ran lengthways with the oval, and that assisted in yielding a good surface finish [1.1.1].

The frame factories delivered frames of all sizes, all profiles and ornaments and all manners of surfaces, e.g. painted, gilded, with spun metal inlays and also natural. The skills shown in the production of these forms were excellent. Today those same skills are less easily found.

However, the oval frame form still compliments many a picture format. The ovalturning of picture and mirror frames is still of current interest and provides a special challenge.



The simplest form and therefore the simplest task is the production of a rectangular frame with an oval profile and an oval recess [2.2.10]. Up to a certain size – about 14 by 19 centimetre - the rectangle can be made from a solid board. Hard woods are preferred. In order to avoid warping, the grain of the frame blank boards should run as shown in figure 5401a, but not as in figure 5401b. Larger rectangles should be made up of 4 parts (figure 5402).

Figure 5401
Oval frame of a rectangle board

6 Methods of Ovalturning

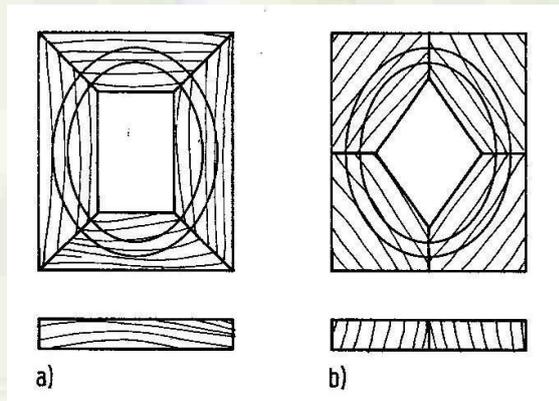


Figure 5402 Rectangle frame blanks
a) Quarter-sawn b) Plain-sawn

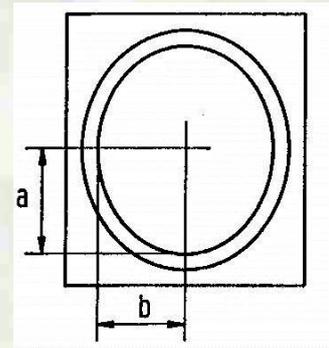


Figure 5403 Half-axes
of the picture ellipse

The picture-ellipse should have an axis ratio matching with the picture, e.g. for portraits b/a not smaller than 0,75 (figure 5403).

Rectangular workpieces are chucked in the two-jaw chuck as seen in figure 5405 fixed on the ODM15 (with adjusted [lightline](#)). The two ellipses, between which the profile is to be cut, are drawn onto the running workpiece using a fixed marker set exactly at centre height (figure 5405).

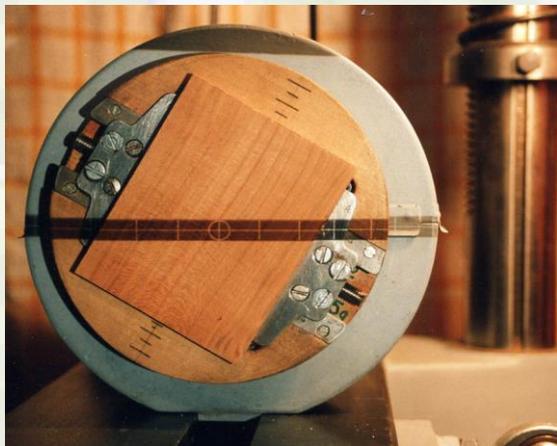


Figure 5404
Frame rectangle in the two-jaw chuck at the ODM15

Figure 5405
Drawing the ellipses bordering the profile

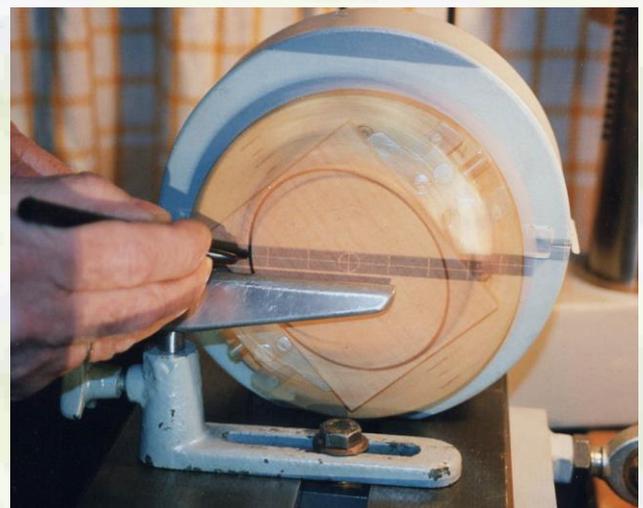
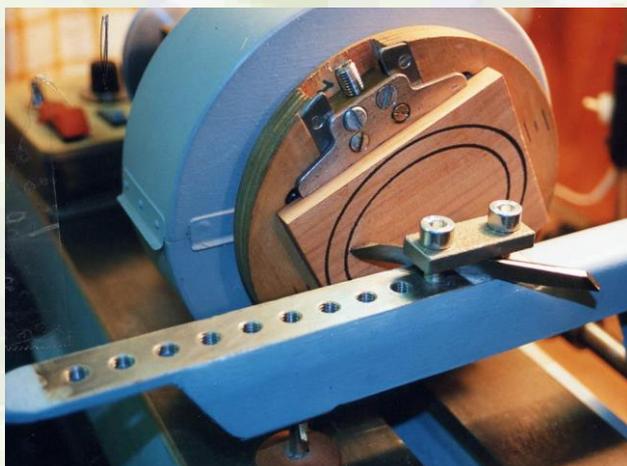


Figure 5406
Marking the picture-ellipse by the piercer



It always pays to make a series of the same pieces, and it is profitable to use the piercer to produce recesses exactly equal in size for all

6 Methods of Ovalturning

frames of the series (figure 5406). The recess and the profile are cut using narrow pointed gouges. The bottom is flattened using a straight edged scraper. Take care to leave sufficient thickness TH at the back of the frame. The profile is sanded to a fine finish using folded sandpaper (figure 5408), the front is cleaned up using a sanding block. The distances of the profile from the opposing rectangle sides should be equal (figure 5409).



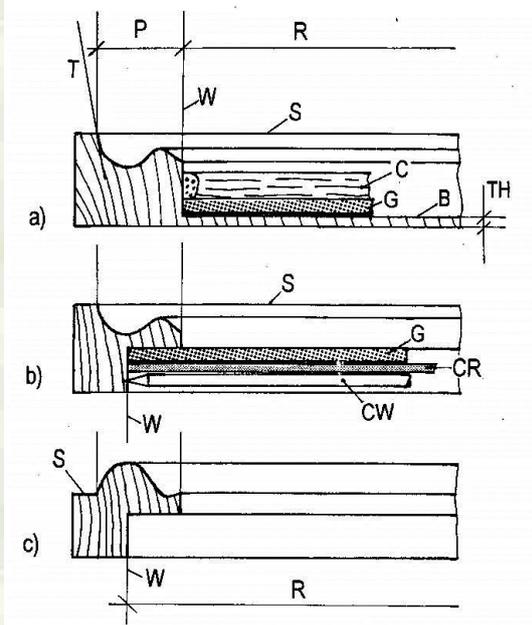
Figure 5407
Turning the profile and the recess



Figure 5408
Sanding the profile near the central line



Figure 5409
Finished frame, bottom flattened by scraper



It is preferably to turn the profile P within the rectangular border S (picture 5410a and b), because a protruding profile (figure 5410c) requires to turn over the rest of the rectangle area S. This is difficult to turn cleanly because of the interrupted cut. The picture B can be put into the frame from the front side (figure 5410a) or into a recess in the rear (figure 5410b and c). The picture B, an inlay or a passepartout and the glass G are held by a rattan clamp-ring C (figure 5411). On the rear recess two curved wires CW keep the cover CR down [2.2.10]. Glass, passepartout, inlays and cover are cut by means of an ellipsograph provided with a cutting wheel or knife

Figure 5410: Frame cross sections
S frame area, R picture area, W recess edge, P profile area, B picture, G glass, CR cover, C rattan clamp-ring, CW curved wires, T profile tangent, if possible vertical to S, TH thickness of bottom
a) front recess b) rear recess c) rear recess, protruding profile

6 Methods of Ovalturning

Figure 5411
Glass or acetate sheet, inlay and rattan clamp-ring,
on the right fitted in place



Figure 5413
Holes on the rear for
hanging the frame on
small nails vertical or crossways

The methods described above are also used when making larger oval frames, but at the start the blank is chucked in the claw chuck for turning the rear and the recess W, the flank FL of the picture ellipse and the chamfer F of the outer contour (figure 5414 above). The workpiece is then turned over and chucked on prepared hardwood jaws of the four-jaw chuck. The last steps are turning and sanding the profile and outer contour (figure 5414 below).

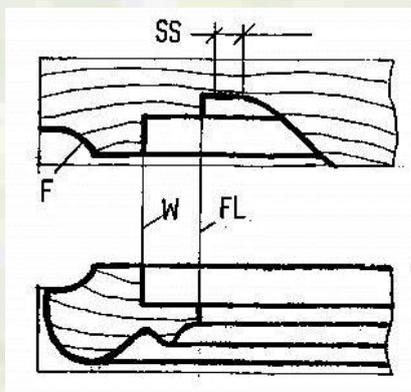


Figure 5414
Sequence of work with big frames
W rim of picture recess, FL flank of picture ellipse, F part of rear
contour, SS space for jigsaw

6.7 Ovalturning of bowls

Example: Big rustic bowl of wet cherry.



Figure 5501

Saw oval (elliptical) blank on the band saw using a template, mass 7kg, screw the blank with hexagon headed woodscrews from the rear of the faceplate, place between the work and the faceplate a protective cardboard disc.

6 Methods of Ovalturning



Figure 5502

Turn outer contour of the bowl using pointed 16mm gouge, on the base turn a 10mm deep spigot.

Figure 5503

Screw a hardwood board to the faceplate, turn a recess to match the spigot, press the bowl spigot into the recess, do not hammer, apply pressure only to the middle of the bowl (5.7kg).



Figure 5504

Adjust [lightline](#) using the template.

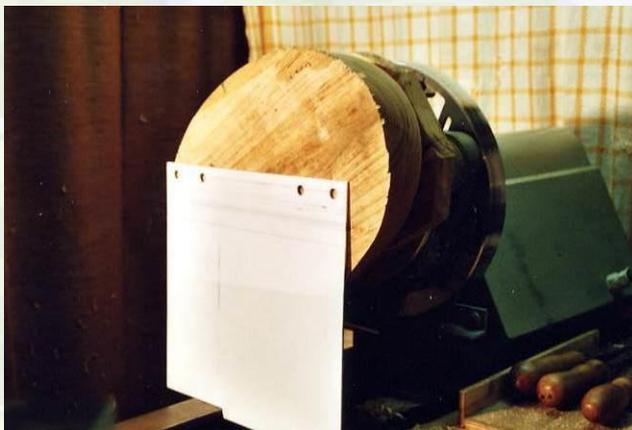


Figure 5505

Hollow using a bowl gouge, smooth with rounded scraper.



Figure 5506

Wrap bowl in newspaper or place it in a cloth bag, with shavings, to dry. Wind a steel band around against cracking of the end grain. At intervals tighten the band using the screw lock. Once it is dry remove the spigot, sand the bowl roughly and oil it (1,6kg).



6.8 Ovalturning of Long Grain Work

Workpieces are described as long grain work when the grain runs in direction of the spindle axis. When circular turning long grain pieces – e.g. banisters – they are turned between centres. When ovalturning this method is impossible due to the ellipse motion. The workpiece cannot be supported by the tailstock centre. Short long grain pieces can be chucked in a chuck with normal or extended jaws. Figure 5601 shows a box as example.



Figure 5601
Box of long grain bog oak in VICMARC Four-Jaw-Chuck VM90 on the ODM30 (see figure [7004](#))

J. Volmer developed the special device ELLPIN for ovalturning of long workpieces [\[2.2.20\]](#). It consists of a screw chuck with an anti-twist device (see figure [4311](#)), that, via a universal joint on a flange, is connected to the faceplate of the ovalturning lathe. Instead of the screw a cup chuck can be used for small workpieces. In the tailstock spindle is inserted a Morse taper #2 with a live centre but it has, instead of the point, a ball pan made of carbon material. In the pan sits a ball with a pin that has to be pressed into the long grain workpiece. [Steinert®](#) offers a device for long grain work similar to ELLPIN for the ovalturning lathe [picOval](#) [\[5.4\]](#).



Figure 5602
ELLPIN: Device for ovalturning long workpieces (Workshop J. Volmer, type for ovalturning lathe ODM30)

The following figures show, as examples of the application of the ELLPIN device, the ovalturning of cutlery handles and of bashers or mallets. The blanks have to be prepared: they are turned round between centres to the required lengths, holes at the ends are drilled for the ball-pin and for the screw, alternatively a cone is turned to match with the ELLPIN cup chuck.

6.9 Cutlery Handles

Figure 5603

Knife and fork with tang and ferule,
Plastic handles are to be replaced with
ebony handles



Figure 5604

Sawn ebony blanks

Figure 5605

After centre punching both ends the hole for
the ball-pin is drilled



Figure 5606

Turning the conical spigot at the handle end
using a template, white mark on the broad side

Figure 5607

Check the fit of the spigot in the conical hole
in the ELLPIN cup chuck



6 Methods of Ovalturning

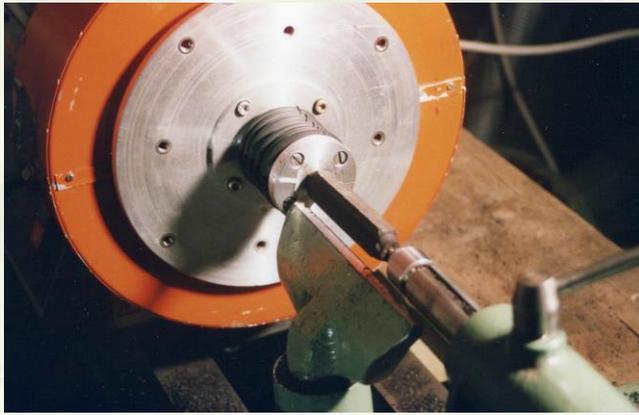


Figure 5608

Press spigot into the hole of ELLPIN cup chuck, and press ball-pin into the blank. Notice the position of the white mark

Figure 5609

Adjust the ellipse mechanism to provide the correct size of the ellipse at the handle end, cut along the lightened central line, the round part at the end of the handle must fit the ferule.

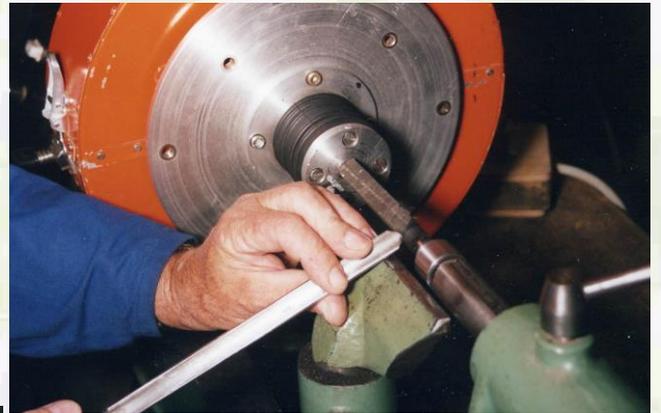


Figure 5610

Sanding and polishing near the central line



Figure 5611

Finished handle

Figure 5612



Pull out the ball-pin using the extractor (workshop J. Volmer) and enlarge the hole to fit the tang, saw off the spigot and sand the elliptical end round.



Figure 5613

Assembling the cutlery: press ferules onto the handles and cement the tangs

6.10 Basher and Mallet

Basher for kitchen work as a meat tenderiser or as a mallet for wood sculptors

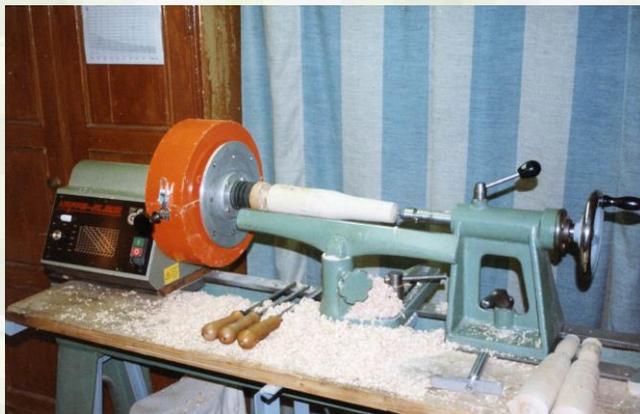
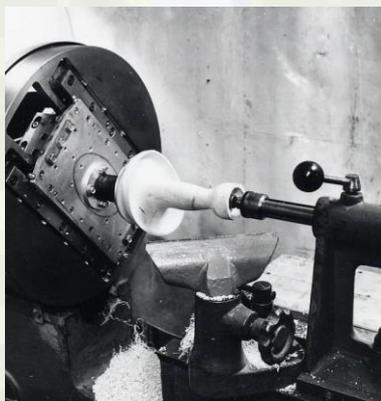


Figure 5614

Ovalturning Lathe ODM30 with ELLPIN (Device for ovalturning long grain work) and chucked basher blank, bottom right the finished bashers: Handle nearly round, basher part with oval cross-section, on the left the extractor for the ball-pin.

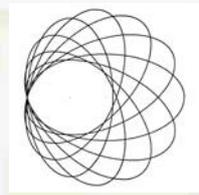
At the start the basher blanks are turned round between centres to the required length. The ends are slightly rounded over. The hole for the ball-pin at the handle end and the hole for the ELLPIN-screw-chuck at the other end are to be drilled coaxially. The blank is now screwed onto the ELLPIN-screw-chuck, and the prong ring – there are two diameters 20mm and 32mm – as anti-twist device must be pressed firmly into the face by revolving the wooden disc. The ball-pin is pressed into the handle end and the ball inserted in the ball pan at the tailstock.



The possibilities of the design of shapes and profiles of objects turned using the ELLPIN device are endless. Some experimental candle-holders have been produced.

Figure 5615

Experiments using ELLPIN at the Ovalturning Device ODV (see Figure [3306](#)) with wide cross and long grain pieces (Workshop J. Volmer 1986)

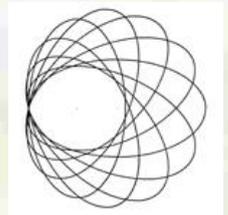


7 Sanding

When sanding oval turned work the same methods and materials are used as when sanding circular turned pieces on the lathe. It has to be taken into account that when sanding the workpiece on a running ovalturning lathe abrasive paper and rotating sanding pads can only be held on the area of the central line, though. The sanding systems offered for circular turning have been successfully tried and tested for ovalturning, and they work well. But remember: What is not cut cleanly cannot be sanded cleanly.

8 Finishing

There are no special methods for the surface treatment of oval turned pieces, except that apply the finish, e.g. varnish, on the running workpiece is only possible around the central line.



9 Ornamenting

9.1 Decorations

Oval turned objects can be decorated by painting, carving or ornamentation. Ornaments are cut into the surface using routers or rotating profiled cutters. The early Ornamental Lathes, e.g. those made by Holtzapffel in England, were equipped with the relevant mechanical devices. Many of these devices were invented by the mechanics and court turners of the European sovereigns [\[1.1.3\]](#).

Many of the early artifacts of former times, which are now preserved and can be seen in museums, seem to us to be overloaded with decorative elements, but they prove the extraordinary skill of the old masters and the existence of ingenious mechanisms. Even today ornamentation can increase the aesthetic value of oval turned objects. The artistically ambitious ovalturner has wide scope for design. There are no real rules to use as a guide when adding decoration. It comes down to personal taste.

Decorative details can consist of points, straight lines, circles and arcs, which are cut or routed into the surfaces of the workpieces. Figure 6101 shows a routed lidded oval box made by Foster Giesmann / USA. He was an active experimenter at his complete workshop-made ornamental lathe [\[2.2.4\]](#), [\[3.1\]](#), equipped with a Rivington indexer [\[1.2.5\]](#). Members of Society of Ornamental Turners (SOT) in England [\[5.11\]](#) and in the USA add to the range of wonderfully decorated oval turned (or milled) objects.



Figure 6101 Oval lidded box with equally spaced routed ornaments (Foster Giesmann / USA, 1998)

The ellipse itself can be used as ornament, for instance when using the oval chuck and a fixed or rotating knife a series of ellipses may be cut into the lid of a plain box. Examples of interesting patterns are to be found in the Holtzapffel book [\[1.2.1\]](#). Figure 6102 shows examples.

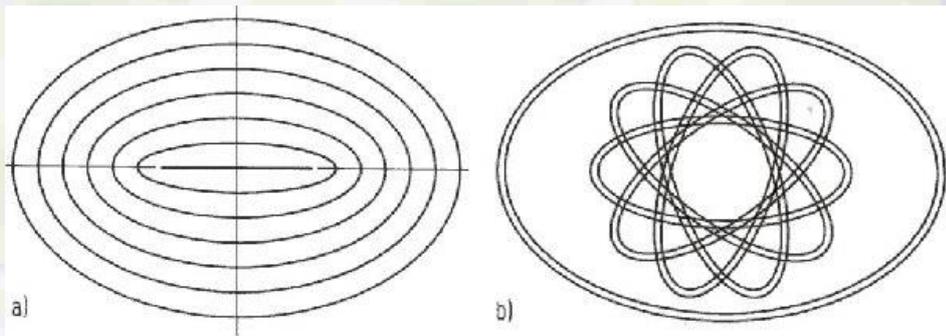


Figure 6102 Ellipses as decorative ornaments

- a) Ellipses with same axes difference
- b) Pairs of ellipses, twisted by 36 degrees

9.2 Division of the Ellipse

When locating ornaments lengthways around an ellipse the old problem, to achieve equal distances between the ornaments, is discovered. This problem does not appear with circular turning; dividing the circle is achieved using the division plate. If a division plate is used in conjunction with the oval chuck unequal distances between the division points result (figure 6103a). Using the Indexer, a special mechanism, equally spaced division points are obtained (figure 6103b) [1.2.5].

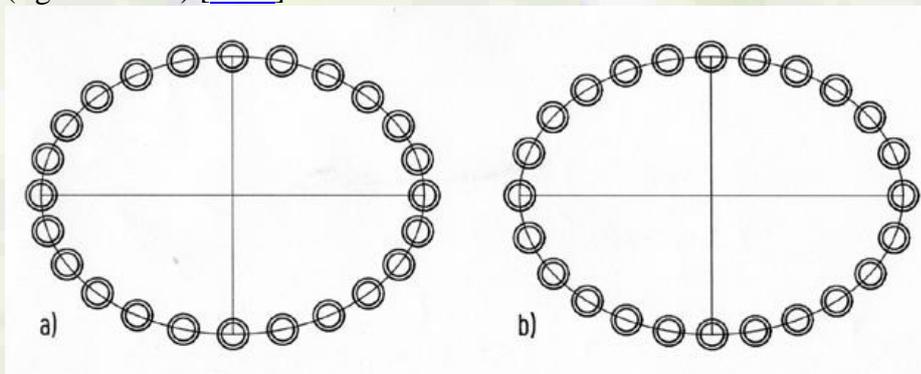


Figure 6103 Division of the ellipse in 24 parts

- a) by division plate: distances unequal
- b) by Indexer: distances equal

By means of the band-method the [perimeter](#) of the ellipse can be easily divided into a required number of parts. At a single workpiece one can try to find the division points by trial and error. Calculate the perimeter and divide by the required number. This is approximately the distance for a trial using the dividers.

9.3 Band Method

Wind a paper tape PB around the workpiece on the ellipse to be divided in n parts. Push a needle through the paper tape at a point on the vertex line h (figure 6201a). Stretch the band PB out on a drawing board. The needle points are the start-point A and the end-point B. Draw the line AB, divide its length $l = AB$ by n and set the dividers to the closest round number.

9 Ornamenting

Draw this distance n times on an arbitrary line g , beginning in A . The end point is C . Draw the line CB and parallels of CB through every point of line g , thus providing the dividing points on the tape. Rewind the tape in same position and mark the dividing points onto the workpiece.

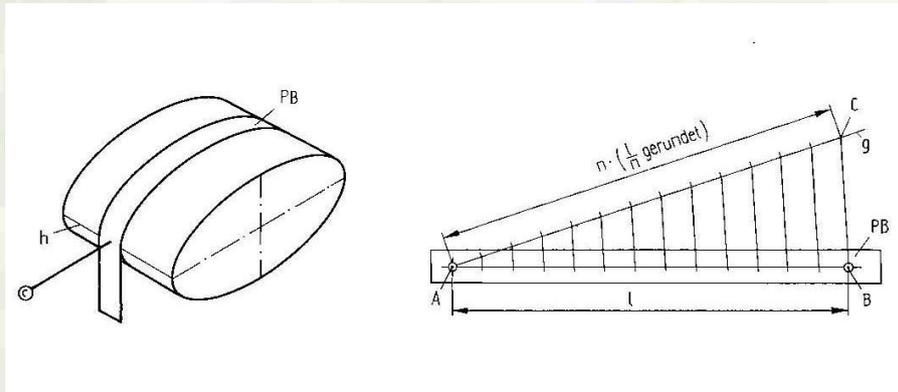


Figure 6201 Bandmethod

- a) Paper band PT around the elliptical workpiece
- b) equal division of the line AB in n parts

9.4 Indexer

Indexers are mechanisms that make possible the equal division of an ellipse on an oval turned workpiece [2.2.17]. The workpiece is held in the oval chuck or on the ovalturning lathe whilst the indexer is used to equally divide the elliptical edge or face. A motorized tool, a router or a profiled cutter, is positioned on the central line when cutting the ornament into the surface of the workpiece. Figure 6301 shows, as an example, the cutting of 30 equally spaced small circles on the face of an elliptical cylinder chucked in the classic oval chuck.

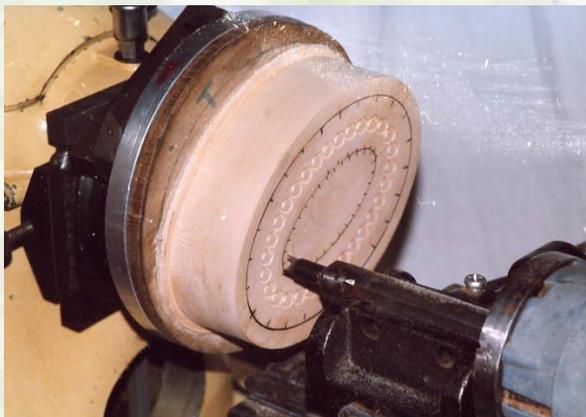


Figure 6301

Cutting of 30 circle grooves equally spaced along an ellipse on the face of cylinder on a classic oval chuck (Workshop E. W. Newton, Bradford 1994)

Figure 6302

[Indexer ICI](#) for the classic oval chuck (Workshop J. Volmer 1994)



Holtzapffel [1.2.1] describes the „Compensating Index“ as an Indexer. This ingenious but probably empirically dimensioned mechanism was invented around 1830. A kinematic analysis [1.2.5] has shown that this indexer could be substantially improved. Hence the „Improved Compensating Index“ (ICI) has been constructed as indexer for the classic oval

9 Ornamenting

chuck (Figure 6302). A detailed instruction for its operation was published by the Society of Ornamental Turning [1.2.6]. For the adjustment of the ICI only the [axes ratio](#) of the ellipse to be divided is of importance, not its size.

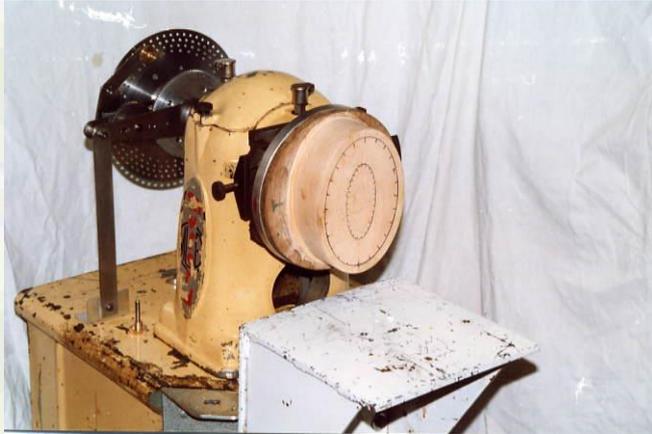


Figure 6303
Indexer ICI installed at the Myford Woodturning
Lathe ML8
(Workshop E. W. Newton, Bradford 1994)



Figure 6304
Indexer for Ovalturning Lathe ODM15
(Workshop J. Volmer, Chemnitz 2001)

The Indexers for the Ovalturning Lathes ODM15 and ODM30 have a simple structure [2.2.17]. The index pin is moved up and down by a linkage dependant upon the revolution of the workpiece. The amplitude of this rocking motion is related to the axes ratio of the ellipse to be divided. The instruction manual gives the relation between the axes ratio and the eccentricity of the driving cam to be adjusted.

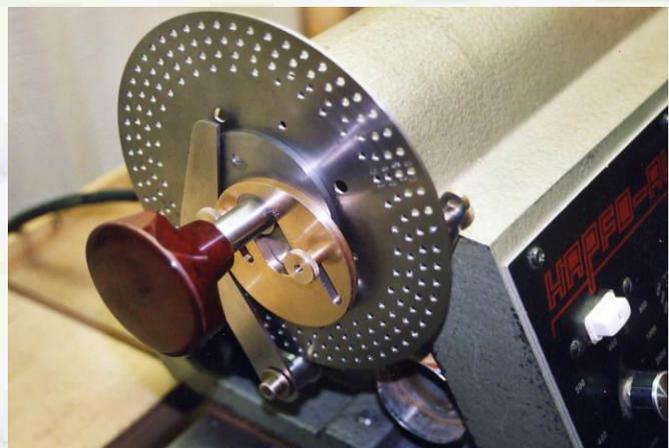


Figure 6305
Indexer for Ovalturning Lathe ODM30
(Workshop J. Volmer, Chemnitz 2002)

9 Ornamenting

The Improved-Lee-Indexer (ILI) has the simplest of structures. It has been designed following an idea of Don Lee, in his time SOT-Member. The indexer consists of a normal division plate and a mechanism made of plain sheet metal parts, simple turned parts for joints and index pin (Figure 6308). There are instructions for its adjustment [2.2.17] [2.2.18].



Figure 6308 Improved Lee-Indexer (ILI)
(Workshop J. Volmer, Chemnitz 2007)

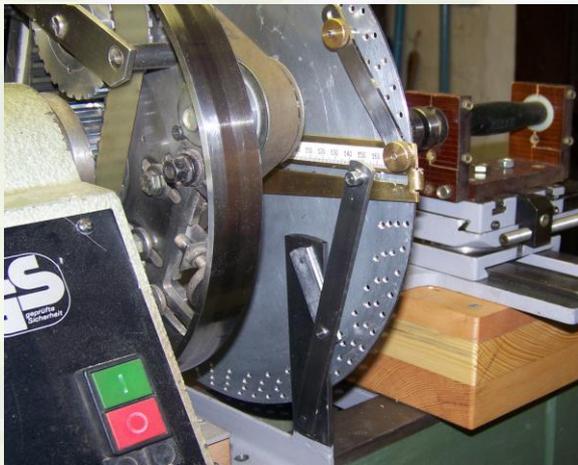


Figure 6309 Lee-Indexer ILI on the ovalturning Lathe ODM30, rear view
(Workshop J. Volmer, Chemnitz 2007)

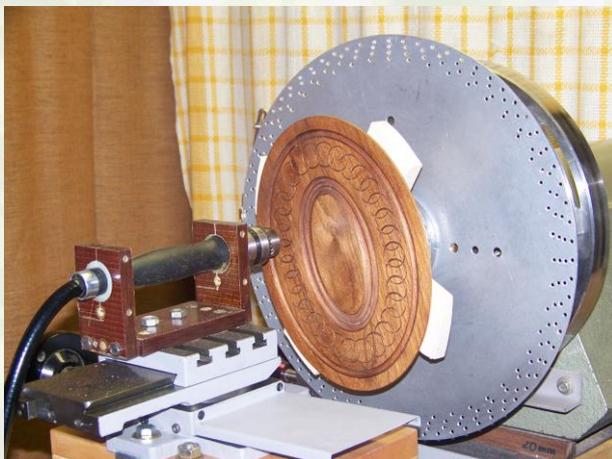
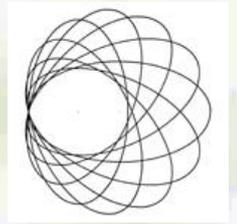


Figure 6310
Chip box cover on ODM30, held by VICMARC-chuck VM90 for cutting 32 equally spaced circles. The router is driven via a flexible shaft
(Workshop J. Volmer, Chemnitz 2007)

Figure 6310 shows as an example the ornamenting of an oval chip box cover by 32 equally spaced intersecting circles forming the barleycorn pattern. The circles are cut with a circle knife made of 2mm steel sheeting, which is held in the chuck at the end of a flexible shaft. The handle of the flexible shaft is in a special holding device mounted on a cross-support.

The Indexer alone cannot firmly hold the workpiece against the forces that arise during the ornamenting process. On the ODM30 a brake, operated by a cam, clamps the main disc of the ellipse mechanism.



10 Design

The following list shows that ovalturning has mainly be used for turning useful articles. The oval turned pieces of the Gallery section originate from the workshop of Johannes Volmer, however there is not an oval turned piece for every example specified in the list. Decorative pieces or "artistic" oval pieces are not shown, only some examples of geometrical studies are illustrated. Professor Gottfried Böckelmann in Hildesheim turned some very beautiful oval pieces on his Geiger Ovalwerk [1.1.6]. It is his opinion that the new ovalturning lathes (ODM) could again reinvigorate the techniques of ovalturning, and he suggests: "It is important that new designs of suitable and relevant oval turned pieces are produced to ensure that the neglected art of ovalturning will continue to be of interest."

In the museums there can be found artistically oval turned artifacts in most varied forms, for examples the goblets and boxes in the Green Vault in Dresden [1.1.5] or the Coburg ivories in the Pitti Palace in Florence [1.1.3]. These old pieces could provide ideas for modern oval turned pieces.

List of oval turned objects for usage	
1	frames for pictures, portraits, mirrors
2	window frames
3	bowls, shallow and deep
4	dishes
5	platters
6	plates
7	trays
8	tureen, lidded
9	boxes, lidded
10	mugs
11	vessels
12	vases
13	cups, goblets
14	bread and meat boards (breakfast and cutting boards)
15	loquets, medallions
16	escutcheons
17	name plates
18	furniture elements: handles, ornaments
19	desk sets (for pencils etc.)
20	hand mirrors
21	brush bodies
22	bracelets
23	jewellery elements
24	napkin rings
25	moulds for press glass, ceramics and porcelain
26	lamp posts and parts
27	Spice mill bodies (pepper), nutmeg grater, salt shaker
28	cutlery handles
29	tool handles
30	bashers (for meat), mallets
31	kitchen treen (spatulas, spurtles, ladles, scoops)
32	pedastel, base, plinth
33	hats, hat molds
34	toy parts
35	music instrument parts (bassoon horn)
36	experiments, tricks, joke article

When drafting oval pieces the designer has one dimension more at his disposal than when designing round objects. So far this advantage has only been used in a classical way. It is suggested that modern forms are explored and past forms are re-examined. At the beginning - also with experiments - a design drawing will stand. Using the computer, as a tool, will allow the more complicated geometrical/mathematical problems to be solved and at the same time produce good working drawings.

Part of the woodturner's apprenticeship is the understanding and production of technical working drawings [1.1.2] [1.1.4]. Today computer programs for drawings are available. One can thereby produce, as soon as one knows or has sketched the intended cross section, arbitrary views of the complete intended piece and also provide an impression of its spatial effect. Rotating a round body, i.e. a rotational symmetric body, around its axis the same figure is always to be seen. It is not the same with oval pieces. The following perspective drawings of the views of an oval bowl in net representation show the very different, partly unexpected figures. Consider e.g. the forms and mutual positions of the two ellipses at the bottom and at the rim of the bowl.

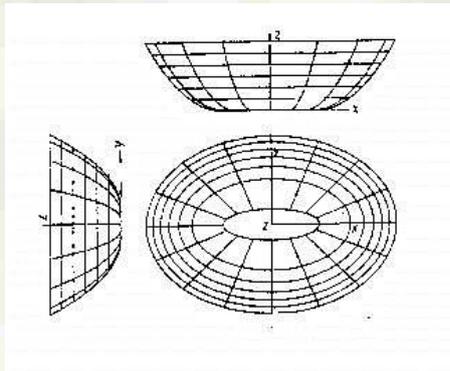


Figure 7001
Side views and top view of a bowl with elliptical contour line and parabolic cross section line

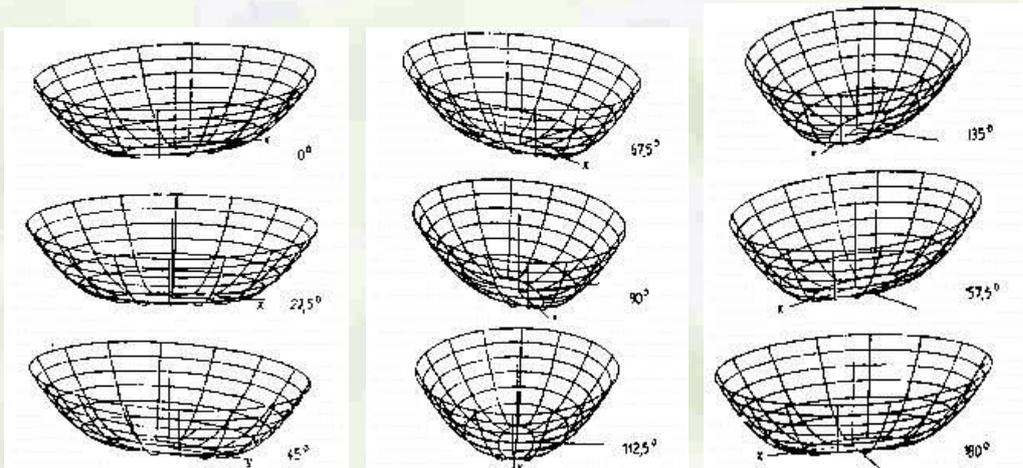


Figure 7002
Perspective views of the bowl of figure 7001
in positions when rotating around its vertical z-axis

When circular turning, interesting forms can be obtained by turning the piece around different axes. A number of books show examples but not all look good. With ovalturning form variants can be achieved only by rotating the workpiece around its central axis. The following figures show those designs, a hexagonal bowl with elliptical hollowings (figure 7003) and a four-edged box with elliptical-cylindrical flanks and circular hollowing (figure 7004). With the cabaret (Figure 7005) the problem presented is to ensure that the five oval bowls and the round bowl in the centre all have the same area.

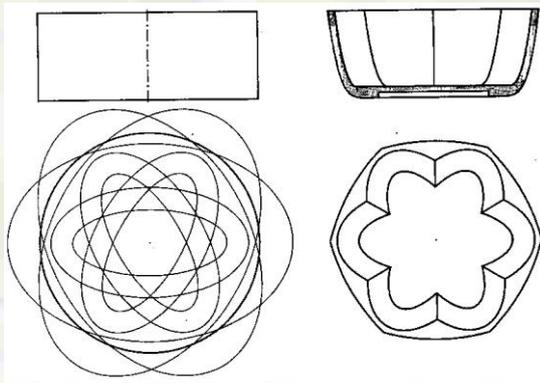


Figure 7003
Hexagonal bowl (HEXBOWL) with three
equal elliptical hollowings, twisted by 60 degree [2.2.24]

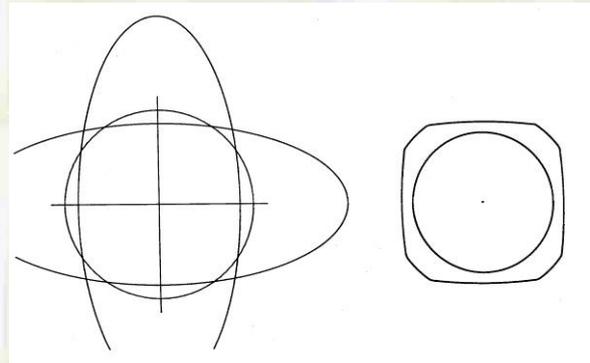


Figure 7004
Tetrahedral box with elliptic-cylindrical
flanks and round internal space

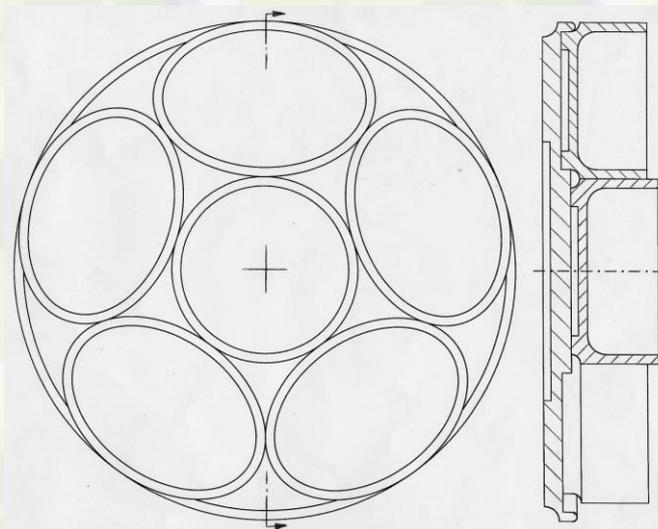
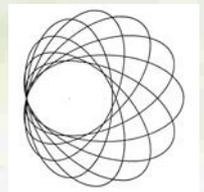


Figure 7005
Cabaret with 6 bowls of equal areas

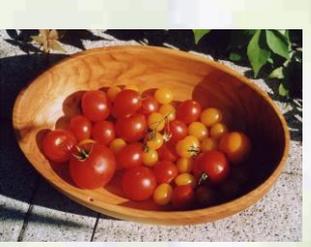


11 Gallery

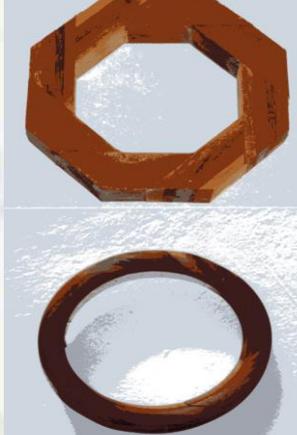
11.1 Frames

			<p>Massive Rechteckrahmen, Bubinga</p>
<p>Figure 7201 Solid frame, mahogany sap-wood, 50cmx38cm (Volmer-Marriage 1953)</p>	<p>Figure 7202 Solid frame, nut</p>	<p>Figure 7203 Two pairs of frames and one small bowl from a padouk-board, 1984</p>	<p>Figure 7204 Solid rectangle frames, bubinga</p>
		<p>okrahmen, vierteliger Rohling, 1996</p>	
<p>Figure 7205 Series of frames, cherry and lime</p>	<p>Figure 7206 Doll house picture frames, ebony</p>	<p>Figure 7207 Rectangle frame, four-part blank, 1996</p>	<p>Figure 7208 Frame of eight-part cherry blank, 1997</p>
		<p>Rechteckrahmen, Bubinga, 1984 (Übersicht, Spiegelverkehr)</p>	
<p>Figure 7209a Double-frame (Larsson-Frame) front side smoked oak, 29cm x 16cm</p>	<p>Figure 7209b Double-frame (Larsson- Frame) rear [2.1.16] oak smoked, 29cmx16cm</p>	<p>Figure 7210 Tray frame, Bubinga, 1984 (Embroidery by Sigrid Volmer)</p>	<p>Figure 7211 Door name plate, teak & enamel, 2005</p>

11.2 Bowls

			
<p>Figure 7301a Bowl, ash, 2002 Decoration by Steffen Volmer</p>	<p>Figure 7301b Bowl, ash, 2002 underside Decoration by Steffen Volmer</p>	<p>Figure 7302 Bowls, spruce 2002</p>	<p>Figure 7303 Bowl with oval rim, pear, 1984</p>
			
<p>Figure 7304 Deep bowl, teak</p>	<p>Figure 7305 Handle bowl, plum</p>	<p>Figure 7306 Set of bowls, plum, wet turned</p>	<p>Figure 7307 Bowl, locust with ebony inlays, 2002</p>
	<p>The oval turned pieces shown in this gallery have all been turned by Johannes Volmer on ovalturning lathes designed and built by himself. These, mainly functional, pieces represent only a small selection of Johannes Volmer's oval turned work since 1983. Different variants have been tested already but the possibilities of ovalturning are nowhere near exhausted.</p> <p>The ovalturning lathes developed by Johannes Volmer guarantee quiet action even when fast running, and they are free of disturbing vibrations. These advantageous properties allow ovalturning directly in living areas which was impossible when using the classic oval chuck.</p> <p>Gerhard Ehrlich</p>		
<p>Figure 7308 Rustic bowl, thuja, 2004, 35cm x 23,5cm x 9,5cm</p>			<p>Figure 7309 Experiment HEXBOWL (see drawing figure 7003)</p>

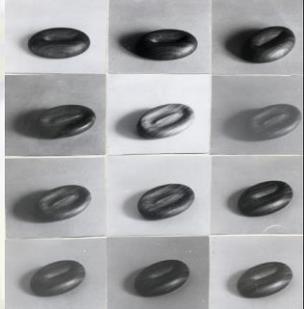
11.3 Platters, Boxes and Rings

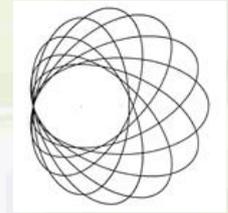
			
<p>Figure 7401 Lidded box, boxtree, 1995</p>	<p>Figure 7402 Lidded box, locust</p>	<p>Figure 7403 Small lidded box, cattle bone</p>	<p>Figure 7404 Four-side lidded box, bog oak, inside round, 2005 (see drawing figure 7004)</p>
			
<p>Figure 7501 Shallow bowl, plum</p>	<p>Figure 7502 Shallow bowl, plum</p>	<p>Figure 7503 Shallow bowl, alabaster, 8cm x 7,3cm</p>	<p>Figure 7504 Potter-bowl, 11,5cm x 10cm x 2,5cm Master Potter Katrin Wirth Chemnitz 1986</p>
			
<p>Figure 7505 Bottom for bread basket, locust</p>	<p>Figure 7506 Rocking bowl [2.1.15], cherry</p>	<p>Figure 7601 Napkin rings, cattle bone (see figure 5202)</p>	<p>Figure 7602 Oval bracelet, 2006 blocked blank by Denver Ulery, Wilmington/PA 1993</p>

11.4 ELLPIN-Objects

<p>ELLPIN is a device developed by Johannes Volmer for ovalturning long grain pieces. The figures are showing a selection of oval turned objects using this device</p> <p>Further experiments should help to discover the variety of shapes to be created by applying the ELLPIN device.</p> <p>Gerhard Ehrlich</p>			
	<p>Figure 7701 Candlestick lady, butternut 1985</p>	<p>Figure 7702 Basher and mallets [2.2.20]</p>	<p>Figure 7703 Candlestick, lime</p>
			
<p>Figure 7704 Candlesticks, Form-Experiments</p>	<p>Figure 7705 Cutlery handles, ebony (see chapter 6.9)</p>	<p>Figure 7706 Candlestick doll (incomplete)</p>	<p>Figure 7708 Spherical oval tea candle stick, locust [2.2.26]</p>

11.5 Miscellanea

			
<p>Figure 7801 Keyhole plates (Escutcheons) cattle bone</p>	<p>Figure 7901 Clock case</p>	<p>Figure 7902 Key tag (Klumpei), lignum vitae</p>	<p>Figure 7903 Hand flatterer, lignum vitae</p>
			
<p>Figure 7904 The Oval in the book</p>	<p>Figure 7905 Doll hat mould</p>	<p>Figure 7911 Oval coaster for round dish Padouk 2009 [2.2.21]</p>	<p>Figure 7908 Lidded chip box with barley corn ornaments (see figure 6310)</p>
			
<p>Figure 7906 Round cheese plate with oval rim</p>	<p>Figure 7910 Key container Half bowl by Richard Raffan, cherry 1991, on oval back plate, 2006 [2.2.13]</p>	<p>Figure 7912 Oval Oily Olive Bowl Iroko, 2010 [2.2.22]</p>	<p>Figure 7707 Ladle with oval bowl Cherry 2004 [2.1.17]</p>



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13 Author

Johannes Volmer (pronounced Follmer), born 1930, grew up in Dresden, the Kings' residence of Saxony, famous for its baroque architecture, art galleries, china and museums.

Following the town's terrible destruction at the end of the war, living conditions forced him, as a pupil and student, to work in several shops. The practical experience he gained of many kinds of handicraft and the machining of woods and metals led to his becoming a machine designer at Chemnitz, an industrial centre of machinery in Germany.

Johannes graduated from the Technical University of Dresden where he also gained higher degrees. His specialities are mechanics and design of mechanisms. He has taught these subjects for 36 years as full Professor at the Technical University of Chemnitz. The country nearby, the forested Ore Mountains (Erzgebirge), is Germany's oldest woodworking region with ancient traditions and unique turning techniques still in use today. Woodturning is widely practised there. It was these circumstances that decided Johannes, some 30 years ago, to devote himself to the theory and practice of the almost forgotten art of ovalturning. His studies resulted in his designing novel ellipse mechanisms for ovalturning lathes which he tested himself. Johannes demonstrated ovalturning, i.e. the turning of elliptical pieces, at home in Germany at woodturning symposia and in countries abroad, e.g. England, the USA, France and Denmark.

With E. W. Newton (1940 - 2009), his long-standing English ovalturning friend, he has founded the Elliptical Turning Association. It was intended as source of information in the internet and as a rendezvous of all fellows interested in ovalturning throughout the world. A number of publications on ovalturning has arisen in German and English magazines.

Johannes Volmer is convinced that once turners have been introduced to ovalturning they will be keen to add it to their repertoire. This script Ovalturning and the ovalturning lathes on the market will hopefully promote this process.

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Acknowledgement

The author is very much obliged to Mr Gerhard Ehrlich for his editing the homepage and the script Ovalturning. Using his specialized knowledge at the computer and his great appreciation of the complicated topic of Ovalturning it was possible to transform the text drafts and picture documents of the author into the attractive form on hand. Without his patient and extensive work the project would not have taken place.

For craftsmen interested in Ovalturning it will be possible by reading this script to receive insight in the versatile and challenging lathe art of Ovalturning. Up to now there was not such a summary.

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The author wishes to thank David Springett for his generous help to improve the quality of the English version of the script Ovalturning. David found it to be an enjoyable and rewarding task to assist in improving the author's English and to edit the text. David himself is well experienced in ovalturning. His excellent book "Adventures in Woodturning" [1.2.4] contains a chapter in which he describes his experiments with his shop-made oval chuck. This can be seen in his video [3.2]. This edition of the script Ovalturning in English will hopefully help to promote the interest in ovalturning throughout the English speaking woodturning world.

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Chemnitz, 1.August 2012