Fig. 1. Black lacquered commode attributed to Dubois; detail of the left side (Berlin, Kunstgewerbemuseum)

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Historical Black Lacquers in Europe

Black Lacquers of the 17th and 18th Century

Black in Japanese and European Culture

Black and red, as well as the characteristical natural colour of the urushi-lacquer, are the most important colours of Japanese lacquer art. It is possible to dye urushi-lacquers blue, yellow, green, or even white with the respective pigments or dye-stuffs; but these colours did only play a peripheral role in the long course of its history. Black lacquered objects, like for example black lacquered tableware (fig. 2), have at all times held their position in Japan at official occasions and festivities. Black lacquers have therefore been a main component of Japanese and East Asian art and culture for centuries.[1]

Black did not play any role in the early art of Europe, not even in painting, until around the year 1500. This is equally true for Italian as for Early Netherlandish painting, the supports of early European painting in general. Black has only been used for the drawing of contours, but not as a flat-spread applied paint. It was only Leonardo da Vinci who began to shape shades with black colour.[2] Until that time black was not even considered a colour. Black lacquers are therefore not rooted within the European tradition. In terms of cultural history they constitute a foreign element and are hardly imaginable without the influence of East Asian lacquers in Europe.

Early European Lacquer Recipes and Lacquered Furniture

The history of European lacquers is rather short compared to the thousands-of-years tradition in China and Japan. It were mainly material problems, that were decisive for the late and hesitant development of European lacquers, and above all problems concerning the lacquer binding media. Black lacquers constitute a special problem within the development of European lacquers in so far as additional difficulties occurred due to the bad compatibility of pigments and binding media, especially within oil binding media. These specific difficulties are running through the European lacquer history in general and have only recently been solved in a satisfying way for modern black lacquers, i. e. for car lacquers.

The laborious way to develop a shining and – at the same time – solid black European lacquer is the subject of this article.

Probably the first description of a European lacquer is found in Theophilus (around the year 1100). It is in chapter XXI: 'De glutine vernition',[3] which can be interpreted as an early description of the procedure of making an amber varnish: Even the chapter on glaze painting (chapter XXIX: 'De pictura translucida') can be interpreted as an early source of a 'varnish'. References to decorative coatings on furniture, which can be regarded as varnishes in the broadest sense of the word, are found for the first time in Venice in the 13th century.[4] But even here, the peculiar interest in lacquers, i. e. in coloured or transparent shining coatings, began only in the 16th century, when Venice became - for a short time - the European centre for the production as well as the trade with high-quality, i. e. colourful painted and decorated furniture.[5] This monopolistic position has been installed by a first wave of imported furniture from Near East, which came to Europe exclusively through trade with the Venetians. Nearly nothing is known about the 'lacquers' on these pieces of furniture and it remains doubtful, whether black ones were among them.

The Development of a special European Lacquer Binding Medium

The sources of the 17th and 18th century contain many treatises and books of travels reporting about the strange stuff called 'lacquer'. Even though it was strictly forbidden one has tried secretly to import this 'glue' pouring out of trees in China and Japan and secreting poisonous vapours in liquid condition, which could be dyed with different colours, from theses countries.[6] Sometimes it may have been successful. But one was not familiar with the drying mechanism of this 'glue' with the effect, that the liquid lacquer dried out during the travel on ships due to humidity and reached Europe only as an unusable, worthless material.

The European attempts to produce a proper material for themselves could only slowly proceed. It is known today, that the news about the Martin brothers in Paris who succeeded first in developing a usable lacquer already in 1730 was only an overstatement. But, nevertheless, this assumption is spread again and again.[7] The truth is, that during the 16th century no considerable progress was really achieved. As for the black lacquers this had two reasons: the incompatibility of black pigments, mainly soot pigments, with oil binding media, as well as the lack of appropriate lacquer solvents for non-oil-bound lacquers.

This was the reason why it was hardly possible until about 1670 to produce lacquers everywhere in Europe, that could compete with those East Asian lacquers imported by the Portuguese and the Dutch.

Drying Oils as Lacquer Binding Media?

The hesitant development of lacquered furniture in 16th century Venice has been influenced by a first Eastern wave of import ware, coming – practically without exception – from Near East, i. e. from the Ottoman Empire.[8] The binding media, which were used for these pieces of furniture, are hardly known until now. Not much earlier a change had taken place in the South of Europe, where oil binding media began to substitute the older tempera binding media in painting as well as in the decorative arts. Oil binding media (drying oils) opened new artistic possibilities, but they brought along a lot of risks and new problems, mainly for black pigments.

Drying oils are plant oils, in terms of chemistry liquid fats (triglycerides). But only those among them, which hardened

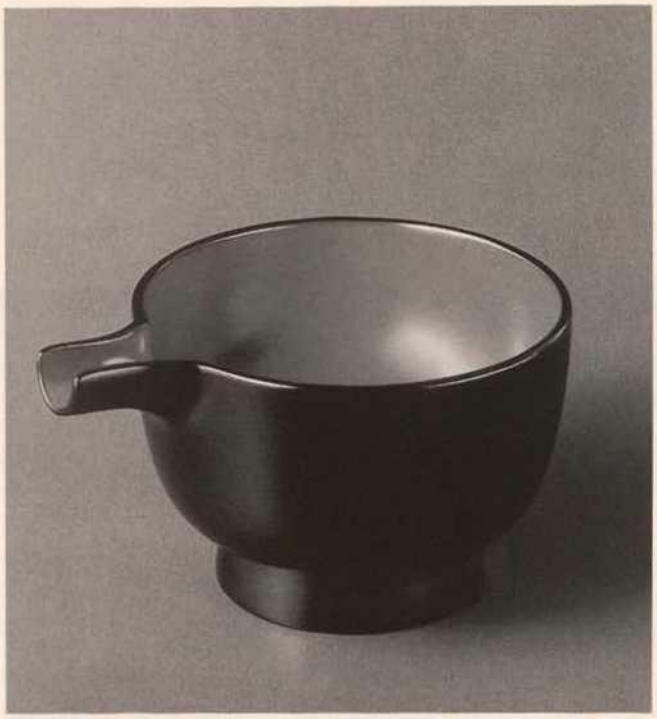


Fig. 2. Modern Japanese tableware lacquered with urushi in black and red

through autoxidation in the open air when applied in thin layers, were adaptable as lacquer binding media.[9] This process is called 'drying'[10] and is dependent on various factors and influences, for example on temperature and humidity within the lacquer layers. Lead-white pigments, above all in thin layers, are favourable for the drying process and serve as stabilizers. Thick lacquer layers and black pigments (soot) slow it down, and may even hinder the drying process in extreme cases. Soot pigments, furthermore, perform a heavily destabilizing effect on oil layers, making damages almost unavoidable (fig. 3). Other pigments (mainly the reactive copper pigments), to the contrary, accelerate the autoxidation process beyond the necessary degree, thereby degrading the binding medium.[11]

In paints and varnishes only one of the many possible drying oils – linseed oil, poppy-seed oil, (wal)nut oil – has practically been used: linseed oil. Since in Europe at the time (and even later) soot (lamp black) was mostly used as black pigment[12], there was no possibility to produce suitable lacquers with pure linseed oil. Auxiliary measures were taken and temporary solutions were found, oriented on those developed in painting: Small amounts of black copper oxide were added to the black oil lacquer, effecting a faster drying. Or, the direct contact between the (linseed-) oil binding medium and the soot was avoided by 'masquing' the soot. This was done by pasting the black pigment at first with a tempera binding medium – mostly animal glue or egg-yolk – , then stirring it with boiled linseed oil[13] and finally applying it in this form. Since boiled linseed oils show a much faster initial drying (but not hardening!) than rough linseed oil, they were used for black pigments as the only binding medium or as an additive (drier) to rough oils. Extremely durable lacquer layers could, nevertheless, not be reached with this method. These measures resulted in black overcoats, but not always in shining black lacquers, which would allow a comparison to East Asian lacquers.

Shellac (Laksha) as a Basic Component of Black Imitation Lacquers

The old trading routes to India, abandoned and forgotten during the Middle Ages (and even beyond) were searched for well-calculated with the beginning colonialism and imperialism, reestablished and revived. The direct consequence was a second and decisive wave of imported lacquer objects, mainly in the 17th century, this time from Far East. It was the epoche which confronted the cultivated upper class in Europe for the first time with black lacquers. On their way to the Far East the Europeans also came across the stick-lac in India, the raw material for shellac, and became familiar with it; shellac was a historical raw material for lacquer, known since the Neolithic period and the terminological basis for the word 'lacquer'. In the course of the 17th century shellac became the preferred lacquer material for Chinoiseries.[14]

For 'white lacquers', i. e. for clear, transparent gloss lacquers, it could not be used because of its red, resp. yellow-brownish natural colour. But it was perfectly suitable for black lacquers and has also been misunderstood for some time as original Chinese lacquer. This misunderstanding lasted for almost the whole of the 17th century[15], and even though it was corrected towards the end of this century, it has not impaired the great popularity of shellac, favoured for red and black imitation lacquers.

But, at first, problems occurred in the practical application of shellac as a binding medium in lacquers, resulting from the solid aggregate state and the dissolving characteristics of this natural lacquer raw material. For comparison, the urushi raw material flows as a viscous sap from the tapped trunk of the tree and can be used in this form as a binding medium (figs. 4–6). The situation is completely different with shellac, a recent resin of animal provenience, won through cleaning and refining of stick-lac (raw shellac).[16] Stick-lac is the secretion of the lac insects, native from India, which infest certain bushes and trees. The secretion becomes firm rather fast and can therefore be won from the branches coated with it as a resin crust (figs. 7–8). But in this solid form neither stick-lac nor shellac, won from it, can be used

Fig. 3. Damage caused by soot in oil layers

Fig. 4. Urushi plantation

Fig. 5. Winning of Urushi sap

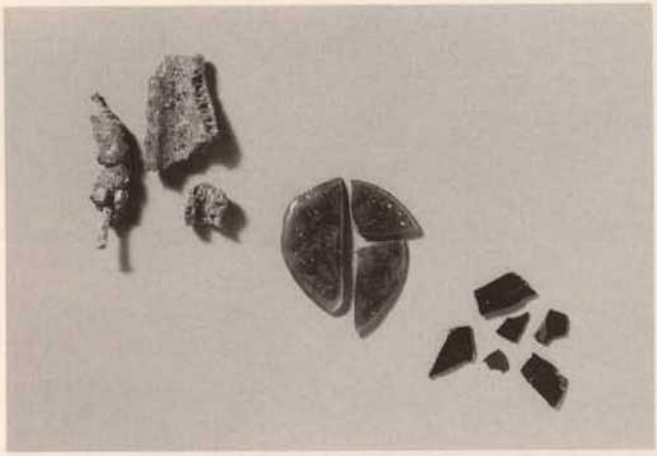
as a lacquer. They have to be, at first, brought into a pasty form, i. e. the shellac has to be made liquid, in some way or the other.

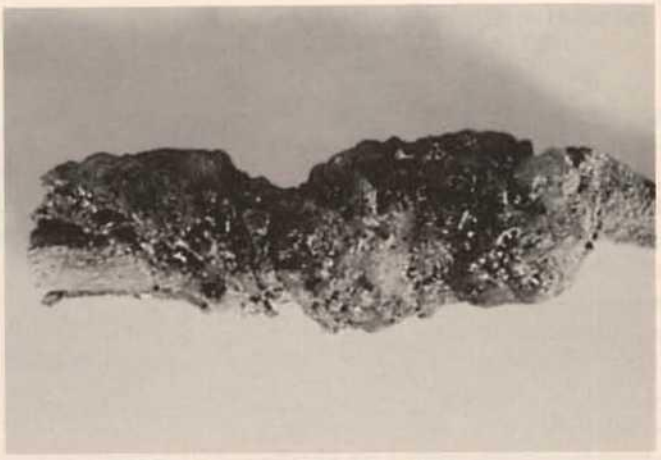
The Indians developed a method of melting shellac onto the objects, that had to be lacquered.[17] Since this method could not be used for black imitation lacquers on furniture, one had to look for a new solution. It was found by bringing shellac into a solution. Nevertheless, the choice of (lacquer-) solvents was very small in the 16th and 17th century. Some essential oils, like e. g. turpentine-, spik-, lavender- and rosemary-oil were at disposal, as well as spirit of wine, later on called spirit or alcohol. Since shellac is not soluble in essential oils, alcohol remained the only alternative. But this was the source of further difficulties during the 16th and the first half of the 17th century. Alcohol could not be produced in pure form, it contained too much water and, therefore, had only a small dissolution capacity. Though it was known since the late Middle Ages, how alcohol could be distilled to brandy or spirits, methods to reduce the high water content have only been developed some time later. Surprisingly modern methods were used and even so called 'drying agents'. These were salts, that could be freed from water by heating. In contact with a humid medium they absorb water and bind it into their crystalline structure. During the 17th century tartar, the deposit of wine, was used to 'dry' alcohols. We do not know until now, to what point of time this method was developed. It is only secured, that it was possible around 1670 to produce spirit lacquers on a shellac or sandarac basis and that this procedure was not to be realized yet around 1600. With the production of a soluble shellac-lacquer the way was open to the development of European black lacquers. Soon afterwards the first black European lacquer cabinets were made.

Practical work shows, that it is indeed possible to produce shining black lacquers with shellac solved in alcohol and black

Fig. 6. Homogenization of the fluid urushi sap

pigments.[18] The production of black lacquers from shellac as the only binding medium is also described in contemporary sources.[19] Nevertheless, our investigations on black lacquered boards from the late 17th and 18th century have – surprisingly – shown so far, that, at least in Central Europe, pure shellac was practically never used. We always found resin mixtures, mostly build on the common basis of shellac and sandarac. Besides, larch turpentine, molten amber, soluble copals, mastic, elemi, camphor and small amounts of oil are to be found, almost the same variety of products known to us from our investigation on gloss lacquers.[20/21] As for the pigments, not only soot (lamp black) was found as referred to in contemporary literatur[22], but also other pigments, like e. g. bone black, wood-tar, bitumina or metal oxides.





Figs. 7, 8. Stick-lac and dark shellac types won through melting, filtration or extraction. Bright shellac types, won through extraction and afterward bleaching of the stick-lac, have only become a trading good towards the end of the 18th century. The stick-lac (upper left) is taken as a resinous crust from infested branches (cf. fig. 8)

Even though it was possible to produce a shining and polishable lacquer with only one layer of shellac and black pigments, we found at least two main layers in all the investigated objects: one black pigmented fundamental layer and one translucently pigmented or transparent upper layer as a finishing lacquer. The binding media in the pigmented and in the gloss lacquer layer always contained the same components; only their relative amounts were different.

Cheaper Lacquer Versions

For what reason no pure shellac was used in all the investigated black imitation lacquers must be left to speculation. For good reasons it can be assumed, that financial motives have been decisive. Good quality shellac was difficult to buy and expensive. In comparison, all the other listed materials, with the exception of camphor and mastic, were much less costly. In the case of the investigated imitation lacquers we found blended spirit lacquers on a shellac basis.

Furthermore, it speaks in favour of this version, that one has always systematically tried to find cheaper versions of black lacquers. At first, the isolated wooden surface was painted with a black coating with animal glue as a binding medium. The shine and therefore the character of a lacquer was finally achieved in a second step, by coating the coloured paint with a gloss lacquer. This finishing lacquer contained in most cases no shellac components and was oriented in composition on the transparent gloss lacquers ('white lacquers') described before.[23]

The development of highly pure, almost water free alcohol prepared the way not only for lacquers on a shellac basis, but also for spirit lacquers in general. The main representatives of this group are the transparent gloss lacquers, i. e. the spirit lacquers on a sandarac basis. We found them in lacquer binding media in black lacquers and mostly in cases, when we were dealing with minor precious objects.

Spirit Lacquers on a Copal- and Sandarac Basis

The spirit lacquers on a shellac basis as well as the cheaper forms with glue-bound black coating and a finishing sandarac varnish can be found throughout Europe. On French furniture (Deforge and Dubois), to the contrary, special forms could be identified (cf. figs. 1, 9). They contain copal- and sandarac-resins as main components.[24] Besides, varying amounts of natural resins, as they were found in the gloss lacquers, are contained. The compounding of camphor within these lacquers, a natural softener, is extremely high.

The 'copal' has substituted shellac in this rather expensive special form. The speciality of this type of copal is the fact, that it is at least partly soluble in spirit and shows similarities in its composition to the alcohol-soluble Manila- or Kauri-copals. Both types of copal are in use in Europe only since the beginning of the 19th century. The Kauri-copal from New Zealand was only introduced to England in 1841.[25] On the other hand, it is known today, that the distribution area of the Kauri trees as well of the fossile as the more recent Kauri-resins are reaching further than the Kauri-regions of New Zealand and Australia, comprising the whole of Indonesia, the Philippines as well as Malaysia.[26] The proof of spirit-soluble copals of the Kauri- and Manila-type indicates, that this type has been brought to Europe as a trading good in the 18th century already and possibly under another name, e. g. as 'Oriental copal from the East Indies and New Spain'.

The spirit lacquers on a copal- and sandarac-basis are also built in two layers and consist of one pigmented and one finishing lacquer layer. The resin components used in both layers are basically the same and differ only in their relative compounding. Nevertheless, deviations from this scheme have been found within the French pieces of Criard-furniture. Here, the finishing lacquer layer consists of ordinary 'European' gloss lacquers.[27]

Black Oil Varnishes

With only slight temporal delay, compared to the spirit lacquers, black oil varnishes were developed towards the end of the 17th century. As for the oil varnishes we are – in contrast to the terminology – not dealing with pure oil products, but with oil-resin-mixtures, which had to be melted together by cooking. As an oil component linseed oil was used in the historical lacquers. As a resin component amber, different fossile and recent-fossile copals, as well as colophony (= 'resin'), were at disposal. The resulting oil varnishes have been labelled according to their resin-compounding as amber-, copal- and resin-varnishes (= colophony-varnish-

es). The 'resin-varnish' made from colophony and linseed oil was rather easy to prepare, but it was of minor quality compared to others. The higher-quality amber- and copal-varnishes were, to the contrary, rather difficult to produce, since both resins are insoluble in linseed oil. Therefore, they had to be melted together ('melted in') 'by force' at high temperature (about 300 °C) or brought into a form, that was soluble in linseed oil. The latter occurred, e.g. by 'melting out' the hard fossile copals. 'Melting out' means the heating (or cooking) of copals at an average temperature of 250-300 °C until they melt under steaming off the fugitive components resulting from this process at the same time. The process has to be continued until the copal melt is not smoking any more and a clear melt is left. This leftover, called copal-colophony (or, in the case of amber, amber-colophony), was soluble in linseed oil and could be cooked together with these to a high-quality copal-varnish. Depending from the oil-resin-ratio the results were elastic lacquers with a high oil content or highly shining hard lacquers with a high resin content. The resulting sirup-like products had to be thinned and made more liquid with oil of turpentine before use in order to bring them in an applicable form.

The earliest oil varnishes known until now have been found by us on furniture of the Dagly-workshop in Berlin (around 1700). In the 18th century the best and most elaborate oil varnishes (copal varnishes) have been produced by the Martin brothers in Paris ('vernis Martin').[28] Nevertheless, the oil lacquers remained throughout the 18th century in the shadow of the more brilliant spirit lacquers. Regarded retrospectively they constitute the final step in the development of historical lacquers. They were mechanically more resistant and less affectable by light and environmental influences and therefore they gained ground against the spirit lacquers in the course of the 19th century, to which they were inferior in splendour. Due to their resistance towards weathering they were especially apt as black coach lacquers and did expel all other types of lacquers in this field.

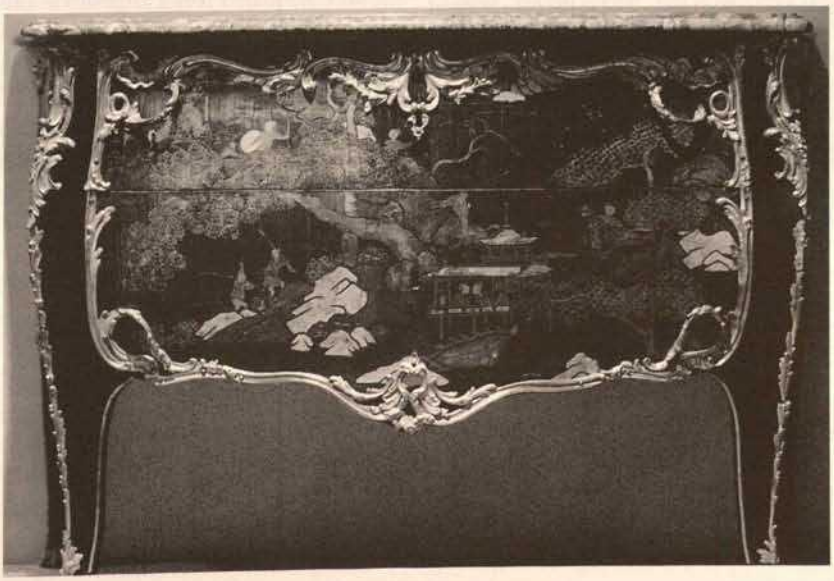
Oil varnishes have been preserved until far into the 20th century and have only been replaced definitively since around 1950 by synthetic resin lacquers. Their complete disappearance from the market was nevertheless not due to a lack of quality. They were exclusively due to the complicated and dangerous production procedure and the high costs caused by them. One further reason was the highly differing quality of the raw materials in use, though resins (copals and amber) as well as those of the oils (linseed-, tung-, castor- and industrial oils). It should not be overlooked in the context of this development, that such an important raw material as amber was practically not available for decades for political reasons.

Acknowledgment

During the six years of research on historical lacquers, carried out within the scope of the German-Japanese cooperation in the field of monument conservation between 1993 and 1998, this paper represents the final contribution and at the same time a sort of conclusion on an important field in the study on historical lacquers. The investigations have been carried out in cooperation with the Bavarian State Department of Historical Monuments.

Our thanks go to the head of the restoration department, Dr. Michael Kühlenthal. Furthermore, we would like to thank especially Katharina Walch, who from the beginnings gave the decisive initiatives and later on contributed important impulses, proposals and questions for our project. From the circle of collaborators of the department of furniture restoration we would like to mention Oliver Morr, Ursula Gassner, Christine Ramsl and Anja Fuchs, who always kindly helped us in the course of our research; we would like to thank them all as well for their continuous support.

Fig. 9. Black lacquered commode attributed to Dubois; front side



Notes

1 Weinmayr 1998, pp. 51–52.
2 Personal communication by Dr. Cornelia Syre, Bayerische Staatsgemäldesammlungen Munich.
3 Anonymous, *Aus der Schedula Diversarum Artium*, in: Technische Mitteilungen für Malerei, 51, 1935, pp. 167–170 and pp. 177–178. Nevertheless, this lacquer has been interpreted by some authors as an early example of a 'vernice liquida', i. e. a sandarac-linseed-oil-varnish. In this chapter Theophilus speaks about 'glue', where we would nowadays say 'lacquer' or 'varnish'. The term 'lacquer' for shining overpaintings has only gradually come into use again after the (re-)introduction of shellac in Europe in the late 17th century.
4 Morazzoni 1954, cited by Huth 1971.
5 Huth 1971, pp. 2 and 16.
6 Baur 1962.
7 Ibid.
8 Huth 1971.
9 Films from oil varnishes are restricted in their thickness because of the hardening mechanism through the reaction with air oxygen. The upper layer diameter lies at 200 µm. Within larger layers the oxygen intrudes too slowly into the lowest areas of the stratum, which therefore tend to remain soft. Since an increase in volume is taking place during the oxidative crosslinking process, the crosslinked 'skin' on top of the soft layer is folded, resulting in the formation of so called 'wrinkles'.
10 The drying is an oxidation process under simultaneous molecular enlargement (oxygen-crosslinking). Besides the first step, the autoxidation, there are only unproven theories up to now about the mechanism of drying. Nevertheless, a polymerization in the sense of macromolecular chemistry is not taking place.
11 Drying oils belong to fats from the point of view of chemistry and can become rancid (deteriorate) just like they do. During this process mainly the unsaturated fatty acids are degraded in an oxidative process. This rancidity process can be accelerated by the presence of certain metals with the lacquer (e. g. cobalt and copper) and slowed down by other metals (e. g. lead).
12 Besides asphalt (bitumen), vegetable black and bone black have been found.
13 Boiled linseed oil is a linseed oil, cooked under the influence of oxygen for several hours at a temperature of about 250–300 °C, under addition of driers, i. e. mixed with metal oxides, which dries much faster than untreated linseed oil. Boiled linseed oils do not show better material characteristics compared to untreated linseed oils, they are even of minor quality. Their advantages in lacquers and paintings lay in the fact, that they dry much faster than untreated linseed oils and that they can be produced in rather varying consistencies, from thin-fluid to viscous. The English term 'heat-bodied linseed oil' in the context of the historical heat-treated oils is not a good choice. It does not clarify, whether stand oils or boiled linseed oils are referred to. Furthermore it gives the impression, that one was dealing exclusively with viscous, thickened (bodied) oils – like in the case of stand oil. Boiled linseed oils, to the contrary could be produced as thickened as well as extremely fluid.
14 Baur 1966.
15 Huth 1971, pp. 21 and 22.
16 Marx 1957.
17 Baur 1966, p. 6.
18 Personal communication by Katharina Walch, Bavarian State Department of Historical Monuments, Munich.
19 Markgräfin Sibylla Augusta, *Die ausführliche und aufrichtige Lack= und Laßurkunst*, in: *Vierfacher Handschrein/Unterschiedlich-angemerkter/Kunst-Speiß-Confitur und Medicinal/Sachen*, personal Manuscript by the Margravine, dated 1688 on the cover. This manuscript is only an example of many contemporary recipes describing pure shellac lacquers. However it is of special interest, because the black lacquer objects commissioned by Sibylla Augusta did not contain pure shellac lacquers.
20 Koller/Walch/Baumer, 'The Lacquers of Margravine Sibylla Augusta' 2000.
21 Koller/Baumer 1997.
22 Stalker/Parker 1960.
23 Koller/Baumer, 'Lacquers of the West' 2000.
24 Koller/Walch/Baumer, 'French Lacquered Furniture' 2000.
25 Trillich 1925.
26 Thomas 1969.
27 Koller/Baumer 1997.
28 Czarnocka 1994.

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Figs. 4, 5: Munich, Bavarian State Department of Historical Monuments, Michael Kühlenthal
Figs. 7, 8: Munich, Bayerische Staatsgemäldesammlungen, Sibylle Forster