

Note from the Making and Knowing Project:

This essay was written for “The Art Technological Source,” an 8-week graduate course at the University of Amsterdam offered by Dr. Marjolijn Bol in 2015 and 2016 to students enrolled in an MA program in either Technical Art History or Conservation and Restoration. Students worked on various recipes from BnF Ms. Fr. 640 on the following five topics: 1) tracing and painting on glass, 2) yellow dyes and their applications, 3) dragon’s blood, 4) painters’ varnishes, and 5) sieves.

This is an un-edited student paper that relies on an earlier state of the Making and Knowing Project’s transcription and translation of Ms. Fr. 640. For an updated version of the text, see:

Making and Knowing Project, Pamela H. Smith, Naomi Rosenkranz, Tianna Helena Uchacz, Tillmann Taape, Clément Godbarge, Sophie Pitman, Jenny Boulboulle, Joel Klein, Donna Bilak, Marc Smith, and Terry Catapano, eds., *Secrets of Craft and Nature in Renaissance France. A Digital Critical Edition and English Translation of BnF Ms. Fr. 640* (New York: Making and Knowing Project, 2020), <https://edition640.makingandknowing.org>. DOI: <https://doi.org/10.7916/78yt-2v41>.

Distilling essential oils

A research into BnF Ms. Fr. 640 and the art of distilling in the sixteenth century

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The Art Technological Source

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Words: 3109

<title id="p003r_a2">Vernis pour tableaux</title>

<ab id="p003r_b2">P{rendre} une lb. de **tourmentine de Venise** & la faire chauffer<lb/>
dans un pot jusques à ce quelle fremisse, et mettre dedans<lb/>
demy lb. d'**huile de tormentine** de la plus blanche que tu<lb/>
pourras, et la remuer bien ensemble sur feu de **charbon**<lb/>
et l'oster incontinent. Et c'est fait. Mays s'il te semble<lb/>
trop espés, adjoustes y un peu d'**huile** d'avantage. Comme<lb/>
aussy s'il est trop cler tu le peulx espessir y mectant<lb/>
un peu de **tormentine**. Ainsy tu luy donneras tel corps<lb/>
qu'il te plaira. Il se pourroit bien faire sans **foeu**,<lb/>
mays estant chauffé il est plus dessiccatif. Il s'aproprie<lb/>
sur les tableaux & aultres choses painctes sans corro{m}pre<lb/>
les couleurs ne jaulnir. Et seiche à l'ombre & au soleil<lb/>
& du jour au lendemain, et aussy bien en hiver qu'en esté.<lb/>
Il se vend communem{ent} quinze sols la lb.</ab>

<note id="p003r_c2a">il fault un peu plus<lb/>
de **tourmentine** que<lb/>
d'**huile de tormentine**<lb/>
affin de donner corps<lb/>
au **verniss**, lequel se<lb/>
doibt coucher avecq<lb/>
le doigt affin de<lb/>
l'estendre plus delié<lb/>
et moins espés, car<lb/>
quand il est espés il<lb/>
jaulnist et grippe.<lb/>
On ne vernist pas<lb/>
pour faire luire les<lb/>
tableaux, car cela<lb/>
ne fait qu'oster leur jour.</note>

<note id="p003r_c2b">Mais c'est pour faire rehaulser les couleurs qui sont imbeues et les garder
de la<lb/>
poulsiere. Le **verniss de mastic** ne soubstient point la pluye mays bien celui d'**huile et rousine**.
</note>

Transcription:

<title id="p003r_a2">Varnish for paintings</title>

<ab id="p003r_b2">Take a pound of **Venice turpentine** and heat it in a pot until it simmers, put in half a pound of the **whitest turpentine oil** you can find and stir all together well on a **charcoal** fire and take it off immediately after, and it is done. But if you find it too thick, add more **oil**, whereas if it is too clear, you can thicken it by putting a little **turpentine**. And so you will give it whatever consistency you want. It could be made without **fire**, but it is more desiccative when heated. It is appropriate for panel paintings and other painted things, without distorting the colors or yellowing, and dries both in the shade and under the sun, overnight, and during the summer as well as in the winter. It is usually sold 15 sols a pound.</ab>

<note id="p003r_c2a">You need a little more **turpentine** than **turpentine oil** to thicken the varnish, which you need to apply with your finger in order to spread it thinner and less thick because when it is thick, it turns yellow and gathers [together]. **Varnish** is not used to make paintings shine, because it just takes the light out of them.</note>

<note id="p003r_c2b">But it is used to enhance colors which have soaked in and to keep them from dust. **Mastic varnish** does not resist rain, whereas **oil** and **rosin varnishes** do.</note>

Introduction

This annotation was written within the course ‘The Art Technical Source’ at the University of Amsterdam, in collaboration with the Making and Knowing Project.¹ This project aims to investigate a late-sixteenth century French manuscript and in this process, produce a critical edition through textual, archival and laboratory research.² An anonymous French-speaking author wrote down a large number of recipes, presumably around the region of Toulouse. The recipes in this manuscript -referred to as BnF Ms. Fr. 640- concern a wide range of subjects, such as medical recipes, making of pigments, the coloring and casting of metal and more.³

The project described above emphasizes the importance of carrying out reconstruction of recipes, when researching a manuscript like BnF Ms. Fr. 640. Reconstructions and the actual production of the material object ‘gives us a firmer handhold on the past than would be the case for non-externalized mental processes’.⁴ In this context several experiments in reconstructing recipes were carried out during the course. I was part of the group concerned with investigating varnishes from two different recipes from BnF Ms. Fr. 640.⁵ We made an attempt to reconstruct a varnish of Venice Turpentine and oil of turpentine, specifically meant for paintings.⁶

Apart from difficulties we encountered whilst trying to reproduce a scarcely explained method, collecting the right materials proved to be challenging. We started out with a type of

¹ Making and Knowing Project: reconstructing the 16th-century workshop on BnF Ms. Fr. 640 at Columbia University New York, access [GoogleDrive](#), 2016

² Pamela H. Smith, *Project Description*. “From Workshop to Laboratory: Experiment and Experience in a Sixteenth-Century Technical Manual” ([GoogleDrive Documents of the Making and Knowing Project](#), 2014): 2

³ The manuscript now resides in the Bibliothèque Nationale in Paris and has been digitized. <www.makingandknowing.org>

⁴ Pamela H. Smith, "In the Workshop of History: Making, Writing and Meaning." *West 86th* 19, no. 1 (Spring-Summer 2012): 12

⁵ BnF Ms. Fr. 640: fol. 3r and fol. 56r

⁶ See Logbook on [GoogleDrive](#). The group consisted of: Rosa Boute, Alma Jongstra, Sepha Wouda, Noa Kollaard, Madeleine Vaudremer, Samuel Johansson, Thijs Hagendijk and Sanne Berbers. The author worked together on the reconstructions of the varnish recipe on fol. 3v with Madeleine Vaudremer and Sanne Berbers.

Venice Turpentine that turned out to contain additions of colophony. In trying to understand the consequences of such an addition, questions about the production of these materials arose regarding the distilling of colophony and essential oils from resins. Therefore, this annotation will first investigate how distillation is mentioned in BnF Ms. Fr. 640 and then examine how this relates to the art of distilling essential oils in the sixteenth century.

The book *Plant Resins* of Jean H. Langenheim gives information on the origin and chemistry of natural materials. Colophony or rosin is obtained from distilling a resin and removing the volatile oil part.⁷ This volatile part or essential oil can also be collected, for example in the manufacturing of turpentine oil.⁸ The type of tree the resin is obtained from determines the chemical composition, although with products of nature differences between the same kind of trees are also inevitable. The process of distilling the resin and separating the colophony from its volatile part, determines the quality of the products. The author-practitioner of BnF Ms. Fr. 640 recommends to use ‘d’huile de tormentine de la plus blanche que tu pourras’ (whitest turpentine oil you can find).⁹ This suggests that different qualities were produced in his time, maybe through distilling multiple times or using different distilling techniques. It is of interest to understand how much knowledge the author-practitioner and possible readers had about this subject.

In order to find out what the author-practitioner might have known about distillation and how this relates to the sixteenth century, the use of additional sources is crucial. First, the manuscript itself is researched for information on distilling, to be able to relate this to the

⁷Joan H. Langenheim, *Plant resins: chemistry, evolution, ecology, and ethnobotany* (Portland: 2003): 27-32, 309.

⁸ Turpentine Oil is usually referred to when the oil is collected from pine trees. Venice Turpentine is collected from larch trees. See: Langenheim, *Plant resins*, 322. Also see the research by Madeleine Vaudremer and Sanne Berbers.

⁹ BnF Ms. Fr. 640: Fol. 3v

sixteenth century distilling-practice. Subsequently, contemporary sources are used to put the manuscript in a broader context by ways of comparing the information in the BnF manuscript with these treatises. This paper will conclude that the information on distilling in BnF Ms. Fr. 640 does fit into the distilling-practice of sixteenth century, though is not representative for this period.

Most contemporary sources do not reference directly to the practice of art but are of a more scientific nature. A selection of sources is made based on relevance and availability to the author. This has resulted in the use of treatises by Biringuccio (1480-1539?), Brunschwygk (1450-1512/13), Porta (1535?-1615) and Plat (1552–1608). To place these works into the development of distillation, Forbes' (1900-1973) book on the history of distillation proved very useful.

Distillation in BnF Ms. Fr. 640

The author-practitioner refers to distilling on approximately twenty folios in BnF Ms. Fr. 640, related to different kind of subjects.¹⁰ Often the adjective 'distille(e)' is used to describe a certain material used in a recipe. For example, 'vinaigre distille' is frequently mentioned.¹¹ Furthermore, the author-practitioner uses 'distille' in imperative mode, as one of the steps in following a recipe.¹² In both cases, he does not elaborate on the process of distilling. Only on four folios an apparatus -called alembick - used for distilling is mentioned, as is also the case on fol. 3v. This folio is of particularly interest because it also shows a drawing of a device for distilling [Fig 1.

¹⁰ For example: Medicinal: fol. 7v, fol. 31r, fol. 38r, fol.107r, pigments: fol. 11r, fol. 031r, fol. 166v, binding medium: fol. 67v

¹¹ BnF Ms. Fr. 640: fol. 031r, fol. 38r, fol. 80v, fol. 102r, fol.107r, fol. 120v, fol. 132v

¹² For examples see: Fol. 55v, fol. 61v

Drawing fol. 3v]. The author practitioner accompanies this drawing with information on the use of this apparatus, therefore this folio is the starting point of this annotation.

It is important to realize that the definition of distilling in the sixteenth century may differ from our current understanding of the word. We now consider distillation as ‘the process of purifying a liquid by successive evaporation and condensation’.¹³ Robert J. Forbes describes the development of distillation in his book *Short History of the Art of Distillation* (1948)¹⁴. He points out that many (late) Medieval authors did not differentiate between distillation, sublimation and filtration. Though the differences between the techniques were known, they were merged together under the general name ‘distillation’. Especially filtration was considered a form of distillation. This can be illustrated by two recipes in BnF Ms. Fr. 640.¹⁵ The first mentions the ‘naturellement distille par les veines de la Montaigne’ (natural distillation through mountain veins).¹⁶ As neither evaporation nor condensation plays a role in this process, we would now consider this filtration rather than distillation. On the other folio, the author-practitioner writes: ‘si tu distilles les susdictes choses par filter’ (if you distill the things indicated with a filter), clearly referring to filtration, not distillation. This discrepancy should be kept in mind when researching a sixteenth century manuscript like BnF Ms. Fr. 640.

Distillation on fol. 3v

¹³ Merriam-Webster, <<http://www.merriam-webster.com/dictionary/distillation>>, accessed March 14th, 2016

¹⁴ Robert J. Forbes, *Short history of the art of distillation from the beginnings up to the death of Cellier Blumenthal* (Leiden: Brill, 1948)

¹⁵ BnF Ms. Fr. 640: fol. 11r and fol. 31r

¹⁶ BnF Ms. Fr. 640: fol. 11r

Fol. 3v in BnF Ms. Fr. 640 is the only folio on which the author-practitioner gives specific information –in writing and in illustration- about the process of distilling.¹⁷ What first stands out is that the folio concerns the distilling of turpentine oil, in large quantities and different qualities. Turpentine oil is not mentioned together with distilling in any other folio in the manuscript, apart from fol. 67v where turpentine is also mentioned. However, here it could still refer to either the resin or the oil of turpentine. The depicted apparatus can also be used to distil alcohol, which is more elaborately described in contemporary sources.

Equally remarkable is the fact that both products of the distilling process are mentioned: turpentine oil and rosin (or *pix greaca*). This is often not the case in contemporary sources as they mostly focus on either the volatile parts collected or the purified liquid that remains.¹⁸ The ability to make large quantities and furthermore the mentioning of the price for selling suggests that maybe the author-practitioner was keeping in mind a commercial purpose which explains the use of both products. However, care must be taken in drawing such conclusions, as the BnF manuscript is characterized as ‘a set of workshop notes’ and it is unknown for whom it was written.¹⁹

The author-practitioner gives instructions on the two main aspects of the distilling process: the heating and the cooling. These aspects are directly related to the important steps of distilling, respectively evaporation and condensation. For heating, he explains to start on ‘petit

¹⁷ BnF Ms. Fr. 640: fol. 3v. English translation: “This vessel is used to make large quantities of turpentine oil, that is to say a bucket an hour. And you can use it to make either regular or high-quality turpentine. As you know, start the process on low heat. And always maintain cold water in the cooler on top. You can sell a lb. for xii sous and the rosin, known as *pix graeca*, remains at the bottom of the vessel. Alcohol is also produced from this vessel and one does not even need to distil it again. You do not need a stove for this copper vessel. You need only to place charcoal around it if the vessel is flat-bottomed. But if it is rounded, you can hang on it on a trivet.”

¹⁸ Biringuccio and Brunschwygk mostly talk about alcohols or do not define the exact substances.

¹⁹ Smith, *Project Description*, 2

foeu', though assuming this is already known to the reader. Contradictory, he also states this copper vessel does not require a stove, but only charcoal needs to be placed around it. This could maybe be an advantage over fire, as volatile oils easily catch fire when in contact with flames. On the cooling, the author-practitioner only tells the reader to 'tenir toujours l'eau froide au refreschissouer den hault' (maintain cold water in the cooler on top). This 'top' of the apparatus he is referring to, is specific to the type of apparatus he has drawn, called a *moor's head*.

The author-practitioner does not elaborate on the type of vessel depicted on fol. 3v, apart from the fact that it is made of copper. Forbes argues that the development of the stills for distilling during the Middle Ages were mainly about cooling methods. Originally the heated vapors were cooled with wet rags and sponges that needed to be replaced continuously.²⁰ This developed into different directions and Forbes mentions different types of still that came into use in this period, including the *moor's head*. This type of still corresponds to the drawing on fol. 3v. Forbes defines that the *moor's head* 'enclosed the still-head in a basin or container which was filled with the cooling water, either continuously or discontinuously'.²¹ In the case of the still on fol. 3v, the water should be refreshed by the user as is also stated by the author-practitioner.

There is little information on the art of distilling in BnF. Ms. Fr. 640. However, fol. 3v gives some interesting clues about the subject. Firstly, the type of vessel that the author-practitioner advices to use for distillation of turpentine oil. This vessel seems to be special, because it is explicitly stated that when using this particular vessel, a stove is not needed. Secondly, there are several clues given about the author-practitioner and potential readers of the manuscript. For

²⁰ Forbes, *Short History of Distillation*, 83

²¹ Forbes, *Short History of Distillation*, 83

instance, the fact that the prices for sale are given and the large quantities of oil that can be produced, perhaps suggests a commercial use of the vessel. Also, the author-practitioner is not very precise in describing the process. For example, there is no specific information given on the type of material that should be put in the vessel, or how much. Furthermore, the duration of the process is not elaborated on. This raises questions about how obvious this information was to the author-practitioner. The fact that the technique of distilling is only mentioned scarcely in BnF. Ms. Fr. 640 could hence also suggest that maybe the author-practitioner had little knowledge about distilling himself. However, the fact that *distilled* materials are often mentioned in the manuscript, possibly implies he must have had some clue what was meant by this.

The *moor's head* in sixteenth century distilling practice

The still depicted on fol. 3v is more often seen in contemporary sources on distilling. As mentioned above, this type of still was cooled with water instead of air, which is a new development in the late fifteenth and the sixteenth century.²² For substances with a relative low boiling point, a better cooling system was especially important. This allowed for lower temperatures and shorter heating times to be applied, which improved the final product.²³

Hieronymus Brunschwygk was a German surgeon, alchemist and botanist, living in Strassburg. He wrote two books on distillation, of which the second is called *Liber de arte distillandi de compositis* (Book on the Art of Distillation of Composites, 1512).²⁴ Brunschwygk studied medicine and his books should not be considered original but rather as a compilation of

²² Forbes, *Short History of Distillation*, 83

²³ *Ibid.*, 80-85

²⁴ Hieronymus Brunschwig, *Book of distillation: by Hieronymus Brunschwig. With a new introd. by Harold J. Abrahams*, transl. from the German, (New York [etc.]: Johnson Reprint Corporation, 1971)

the knowledge and practice of a group of medical practitioners, in Strassburg.²⁵ Several images of moor's head still are present in this book by Brunschwygk. The illustration on fol. 3v shows a very basic type consisting of a main vessel (cucurbit) and the moor's head on top of this. The receiver is not depicted, only a tube attached to the head, where the condensed liquid can come out. The images in Brunschwygk's book depict much more advanced and well-developed forms of this still, though with the same principle [Fig. 2. Moor's Head Still, Brunschwygk]

Another example of the use of a moor's head still is provided by Sir Hugh Plat, an English inventor and writer on agriculture who did several studies on artisans. Plat's *The Jewell House of Art and Nature* (1594) describes different aspects of domestic duties, written especially for women. It contains information about simple household alchemy such as distilling.²⁶ An image of a still is depicted, also with a moor's head cooled by water [Fig. 3. Moor's Head Still, Sir Hugh Plat].

Seth C. Rasmussen explains in his essay on the development of thirteenth century glass-making, how this affected the chemistry in the following centuries.²⁷ The possibilities in making stronger glass led to the development of the glass still, used for the distillation of alcohol and minerals.²⁸ However, a large disadvantage was still the fragility of the glass, as copper or earthenware vessels were still considerably stronger. This may explain why the author-practitioner of BnF Ms. Fr. 640 advises to use a copper vessel for distillation.

²⁵ Forbes, *Short History of Distillation*, 108

²⁶ Bruce Moran, *Distilling Knowledge. Alchemy, Chemistry, and the Scientific Revolution* (Cambridge: Harvard University Press, 2005), 62

²⁷ Seth C. Rasmussen, "Advances in 13th Century Glass Manufacturing and Their Effect on Chemical Progress." *Bulletin of the History of Chemistry*, Volume 33: 1 (2008): 28

²⁸ Rasmussen, "13th Century Glass Manufacturing", 29

The improvements made in glass-making, also led to a different type of vessel used for distilling called the *retort*. This still was no longer composed of separate parts, but made out of one piece. Vannoccio Biringuccio was an Italian technologist who wrote a large treatise on metallurgy, *La Pirotechnia* (1540).²⁹ In his chapter named ‘Dell’arte destillatoria d’oglio, et acque’ (the art of distillation of making oils and water) he touches on the distillation of oils.³⁰ He argues that ‘oils are usually distilled in retorts’, though he does not specify the material the retort should be made of [Fig. 4. Retort, *La Pirotechna*].³¹ Giambattista della Porta was a student of physics and travelled extensively through Spain, France and Italy. He emphasizes in his book *Magia Naturalis* (1558) on the need to distil oils in a retort, because of the danger of the smoke escaping from the apparatus and catching fire.³² A closed still such as a retort is in this case more convenient, though Porta also neglects to tell us the material of such a vessel.

The *moor’s head* still, advised by the author-practitioner, is commonly described in the above treatises and probably also used in the sixteenth century throughout Europe. There is however an increasing tendency to use glass stills and retorts, for extracting essential oils. Although the author-practitioner of BnF Ms. Fr. 640 does not mention the use of these, he does seem aware of the existence of stills made of other materials than copper. His note on the need of tinning the copper, to prevent the substance from turning green, expresses this.³³

Who and where: distilling of essential oils in sixteenth century

²⁹ Vannoccio Biringuccio, *La Pirotechnia*, 1540, trans. C. S. Smith and M. T. Gnudi (Cambridge: MIT Press, 1966)

³⁰ *Ibid.*, 260

³¹ *Ibid.*, 438.

³² Giambattista della Porta, *Natural Magick: by John Babtista Porta*, (repr. New York: Basic Books, 1957)

³³ Fol. 3v (note): ‘Aulcuns disent quil nest bon de distiler dans ce vaisseau de cuivre pourcequil faict vert Touthefois estame il est bon’ (Some say it is not good to distil in this copper vessel since it makes things green. However, when tinned, it is good)

The information on distilling in BnF Ms. Fr. 640 strongly suggests the author-practitioner was familiar with the art of distilling. We have already seen that a lot is written about distilling during the sixteenth century. The treatises by authors such as Porta, Biringuccio and Brunschwygk are only a small selection of writings about the subject. These writers were mostly interested in the chemical, physical and thus the scientific part of distillation. It is not likely that they were themselves experimenting in extracting essential oils. Forbes argues that the production of essential oils in the fourteenth and fifteenth century was mostly concentrated in monasteries and apothecaries.³⁴ From this period onwards, a gradual movement takes place from the distilling practice in monasteries and homes of artisans to larger industrial centers and chemist shops. Around this time, Burgundy was said to have many plantations for medicinal and perfumes.³⁵ The title page of Brunschwygk's book depicts a similar garden [Fig. 5. Plantation and stills, Brunschwygk]. In Dijon as much as eleven large distilleries were in use according to Forbes, to produce oils from these plants.³⁶

This increasing industrial character of the practice of distilling, is in line with the information given in BnF Ms. Fr. 640. Firstly, the author-practitioner gives the prices for which the products can be sold. But more important, the fact that distilled products are often mentioned in the manuscript implies these could be bought in shops. This corresponds to the transition to a more industrial, large scale production of such products. An example of a large scale distillery is the one employed by Anna of Saxony (1532–1585). The book of Sir Hugh Plat discussed previously, illustrated that women were occupied with the distilling practice. Anna was a

³⁴ Forbes, *Short History of Distillation*, 57, 91

³⁵ *Ibid.*, 91

³⁶ *Ibid.*, 57

German noblewoman, researched by Alisha Rankin.³⁷ Anna was greatly interested in the practice of medicine and worked together with other noblewoman as well as physicians. She had twelve ovens and several distilling houses, gardens, apothecaries and two palaces.³⁸ Furthermore, she had employees to satisfy the great demand for distilled waters and oil. The elaborate inventories of her stores include a great variety of distilled liquids, equipment and books on alchemy. This large scale practice provides for a small insight on how products of distillation could have been available in the sixteenth century. Although Anna was mostly occupied with medicine and not the arts, she portrays an industrialized form of distilling.

Conclusion

The practice of distilling is not widely elaborated in the BnF Ms. Fr. 640 manuscript. Although the author-practitioner does seem to be familiar with distilling, as distilled materials are used in several recipes. This can illustrate how common the practice of distilling was in the sixteenth century. Even though the author-practitioner seems to be knowledgeable of the practice of distilling, he does not seem to be aware of the latest developments. Contemporary treatises show that for the distillation of resins and essential oils, different type of stills made of glass were preferred.

The contemporary sources occupied with distilling do not seem to be specifically connected with the arts. For example, Birringuccio and Porta were more interested in the chemical theory behind distilling and others like Sir Hugh Plat connect distilling mostly to medicinal use or perfume-making. The varnish I reconstructed for this course, was meant

³⁷ Alisha Rankin, "Becoming an Expert Practitioner : Court Experimentalism and the Medical Skills of Anna of Saxony (1532–1585)", *Isis*, Vol. 98: 1 (2007): 23-24

³⁸ *Ibid.*, 24

especially for paintings. As a student in the conservation of paintings, the connection between the practice of distilling and the materials used by artists is of particular interest. To know more about the exact materials used by artists can be of great help when designing treatments for objects. The manuscript BnF Ms. Fr. 640, which contains many recipes related to the arts, is crucial in providing a connection between scientific developments of new techniques and the use of them by artists. The rise of large distilling houses, like the one of Anna of Saxony, illustrates the availability of distilled materials in the sixteenth century. Further research on such practices could provide more insight on materials used by artists. In general, comprehensive research into this manuscript, and other similar manuscripts, is necessary to connect the theory and practice of earlier times.

Acknowledgements

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Bibliography

Biringuccio, Vannoccio, *La Pirotechnia*, 1540, trans. C. S. Smith and M. T. Gnudi, Cambridge: MIT Press, 1966

BnF Ms. Fr. 640, access to the folios on Google drive: February-March, 2016

Brunschwig, Hieronymus, *Book of distillation: by Hieronymus Brunschwig. With a new introd. by Harold J. Abrahams*, 1512, transl. from the German, New York [etc.]: Johnson Reprint Corporation, 1971

Brunschwig, Hieronymus, *Liber de arte distillandi de compositis*, Strassburg: Johann Grüninger, 1512, Online available:
<<https://books.google.nl/books?id=Js5VAAAACAAJ&printsec=frontcover&dq=brunschwig,+hieronymus:+liber+de+arte+distillandi>> (accessed on March 19th, 2016)

Forbes, Robert J., *Short history of the art of distillation from the beginnings up to the death of Cellier Blumenthal*. Leiden: Brill, 1948

Gettens, Rutherford J., and George L. Stout, *Painting materials; a short encyclopaedia*. New York: Dover Publications, 1966

Langenheim, Joan H., *Plant resins: chemistry, evolution, ecology, and ethnobotany*. Portland: Timber Press, 2003

Leong, Elaine, and Alisha Rankin, ed., *Secrets and Knowledge in Medicine and Science, 1500-1800*. Surrey and Burlington, 2011

Mills, J.S., & R. White, *The Organic Chemistry of Museum Objects*. Oxford: Butterworth-Heinemann, 1999

Moran, Bruce, *Distilling Knowledge. Alchemy, Chemistry, and the Scientific Revolution*, Cambridge: Harvard University Press, 2005

Porta, della Giambattista, *Natural Magick: by John Babtista Porta 1558*, repr. New York: Basic Books, 1957

Rankin, Alisha, "Becoming an Expert Practitioner : Court Experimentalism and the Medical Skills of Anna of Saxony (1532–1585)", *Isis*, Vol. 98: 1 (2007): 23-53

Rasmussen, Seth C., "Advances in 13th Century Glass Manufacturing and Their Effect on Chemical Progress.", *Bulletin of the History of Chemistry*, Vol. 33: 1 (2008): 28-34

Appendix

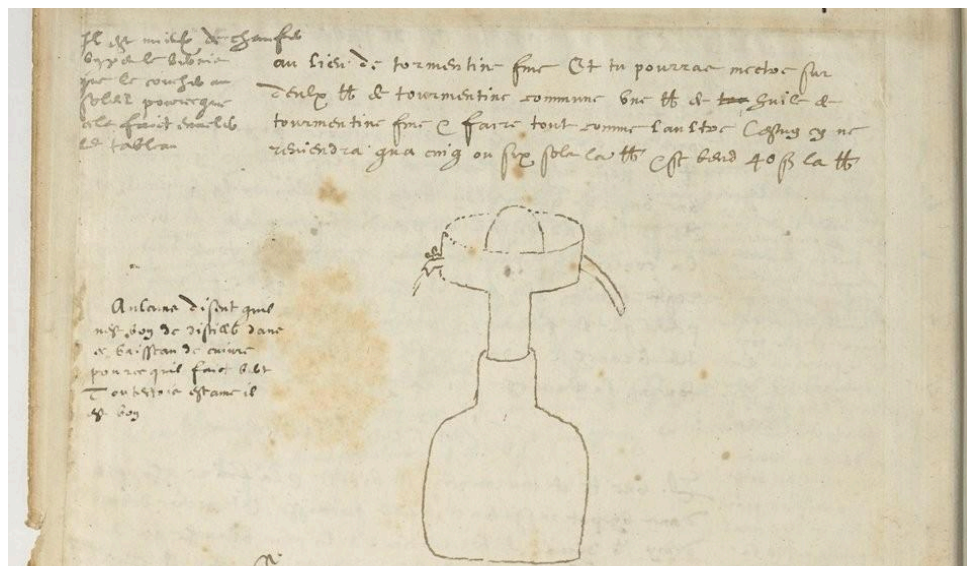


Fig. 1: Drawing fol. 3v. BnF Ms. Fr. 640. Source: The Making and Knowing Project (GoogleDrive, accessed March 19th, 2016). The illustration shows a vessel (cucurbit) with a moor's head on top. Two tubes are visible, one for the distilled material and one for the cooling water. The receiving vessel is not depicted.



Fig. 2. Moor's Head Still, Brunshwyg, 1512 (GoogleBooks, accessed March 19th, 2016). This still is very advanced. The image shows the inside of the 'head', where the condensed material is collected and cooled by the vessel around this. The cucurbit can be filled without removing the top.

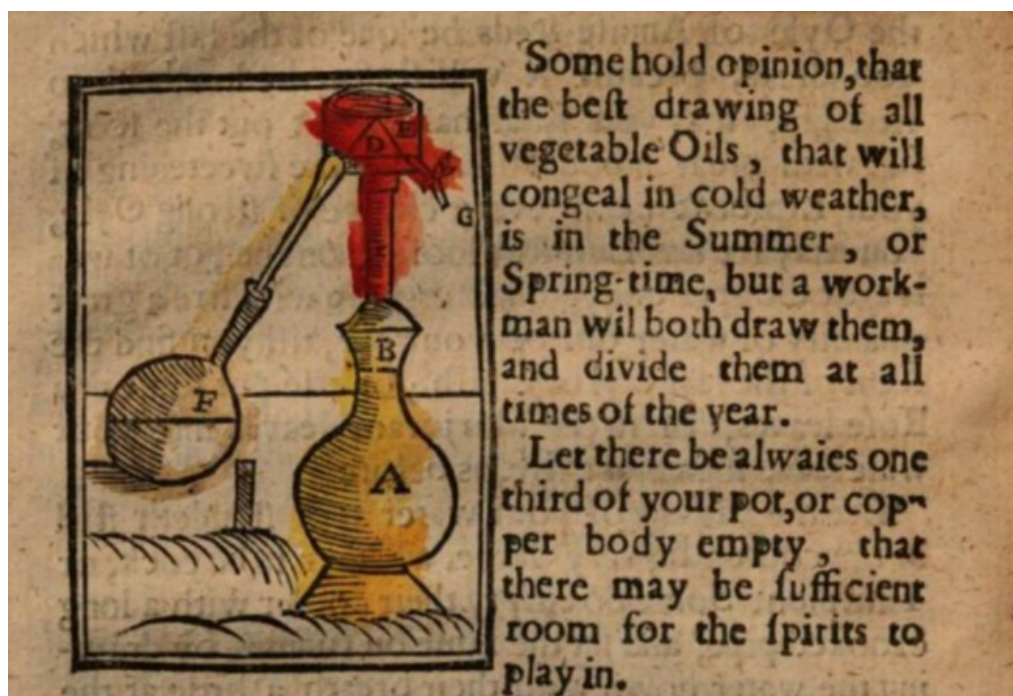


Fig. 3. Moor's Head Still from 'The Jewel House p. 152', Sir Hugh Plat, (GoogleBooks, accessed on March 14th, 2016). This still is quite basic, the cucurbit (A) is shown with a moor's head on top, where cooling water can be poured into. The receiving vessel (F) is connected to the top with a tube.)



Fig. 4. Retort from La Pirotechna, Birringuccio, 1540 (GoogleBooks, accessed on March 22nd, 2016). The still depicted are 'retorts', thus are made of on piece. Notice the shape, typical for this type of still

Liber de arte distillandi, de simplicibus.
**Das buch der rechten kunst
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von Hieronymo Brunschwygk/bürtig vñ wund artzot der Eaiserliche freye stadt Straßburg.



Fig. 5. Plantation and stills, Brunschwygk, (GoogleBooks, accessed March 19th, 2016). This plate depicts several plants and stills. Notice the many workers busy with different aspects of the distilling process, such as making fire, picking plants and pouring liquids.