héliogravures
sensibiliallaluce

HELIOGRAVURE – The BITING

This is the final stage of the process, as far as the copper matrix is concerned; after which will be stages for possible correction on the plate, inking and printing. These operations match exactly the *'aquatint'* technique and tools, and will not be discussed here.

Biting is one of the two most delicate stages (along with transfer).
The copper, covered and taped in any part to be saved from etching, is plounged in several solutions of ferric chloride (commonly named '*perchloride*').

PREPARATION OF FERRIC CHLORIDE SOLUTIONS

For acid solutions, commercial iron salt is used, already dissolved, or solid, by dissolving it very slowly in water under aspiration hood and agitation of the liquid.
The first solution is strongly recommended; just a bit less laborious but certainly less dangerous. In fact, the dissolution of solid salt in water is highly *exothermic* (generates heat) and also produces a lot of foam that can easily escape from the container. This forces to use a *bain-marie* and large containers.

So it can be immediately seen that the preparation of baths requires attention and knowledge of products and materials; the importance of referring to data sheets for any chemical product can be never sufficiently highlighted (1).
Perchloride is found both 'technical' and at higher purity; commercial liquid however usually does not reach the maximum concentrations required for our purposes. We need therefore - in some cases - to operate a spontaneous evaporation (do not use heat) of the liquid - leaving it in a large basin, under aspiration or – protected – outdoors, to increase its concentration, that means density. For other solutions of lower density, the starting solution will be diluted (2).

The baths strength may vary with the personal conditions of the process and will (once again) be subject to test and standardisation 'on the field' (3).
This means that a few tests are needed with the usual reference step-wedge, set on a plate and subsequent check of the etching times through a printout (4).

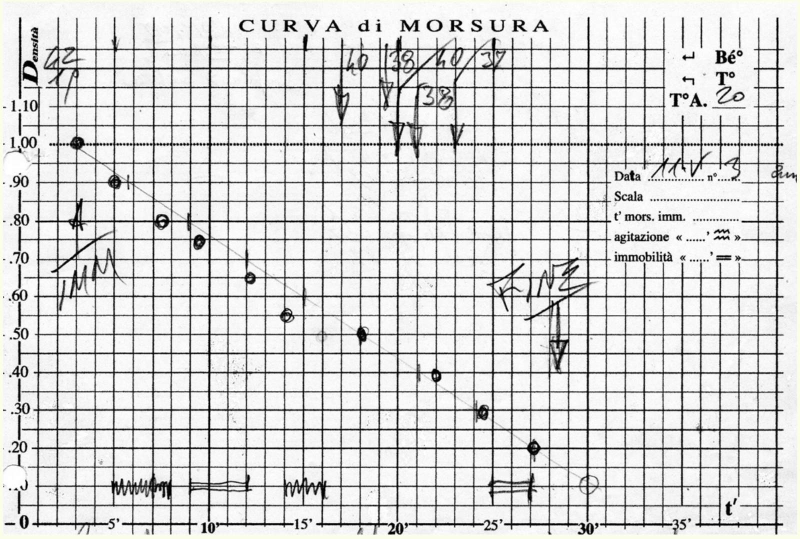
Exemplifying: with a 'proper' stepwedge (i.e., all steps in the range fully printable) between 0.1 and 0.8 in film density, the total time of etching in the baths, will not exceed 24'- 28' (equivalent to about 3'/0.1D), to which should be added the initial minutes – say latency time – for triggering the first useful step (5).
Bath density range normally vary (according to the texts) between 45° and 35° Bè (6); with, for example, 4 baths, a sequence to experiment with, could be 43°- 41°- 39°- 37° Bè. A possible fifth bath may be useful in case of substantial variation of work temperature (7).

N.B.: - For cheking the density values (use of an aerometer) see Appendix 1 (forthcoming 'Appendices '!)
- For the problem of free acidity of solutions (a bit more complex) see a description in Appendix 2.

The BITING

The immersion of the plate in the baths begins from the one at highest concentration, keeping a gentle agitation of the basin, checking that little air bubbles do not hold on to the metal surface and marking the time corresponding to the first useful step etched on the stepwedge placed at the side of the plate. Consider this '*time zero*'. From here, the biting of each step will be evaluated, according the better possible approximation, to a foresee schedule, so as to respect the linear etching for the various steps. When the speed of engraving tends to slow down (too high density of the liquid), we move the plate to the bath of lower concentration (8). The same steps are performed for the following baths. From these manoeuvres it can be understood how relevant is the use of overall protections both personal, including face, and of environment with regard to splashes and drips that may occur, having to operate generally swiftly: one eye to the plate, one to the timer! In addition, the need for such close monitoring, strongly recommend an

aspiration fan over the basins, even though perchloride does not emit fumes or vapours.
It will also be best to report on a form every time, temperature and bath concentration at which the various plate movements take place; it will be very helpful in gaining experience and drawing evaluations. An example and sheet model *x/y* (*time* versus *film density*) is shown below: the black dots, that are steps of the wedge, must follow as much as possible the thin straight line as 'guide' during the biting between 'time zero' and maximum time you choose; the line with numbers at the top, shows the 'back and forth' of the plate through the baths.



FINAL STEPS

At the end of the etching process, the plate is swiftly drained and plunged in a bath of diluted acetic acid or $NaHCO_3$ about 100 g/lt, stirring the basin, so that the ferric salt still present is neutralised rapidly and evenly. (9)
After a few minutes, the plate can be lifted and placed in a basin of clean water to proceed with the cleaning of the gelatine with a soft brush and removing of the covering adhesive tape.
Observe the work with a loupe and make the necessary corrections with the engraving tools.
Then cut out the wedge after satisfactory printing proofs.

NOTES

(1) Also remember that $FeCl_3$ stains are absolutely indelible from clothing and corrosive to the skin. Use impervious clothing - waterproof coveralls and/or apron, gloves, face mask - and absolutely dedicated tools such as tongs and basins during all stages of pouring and etching.

(2) Perchloride can be found in electronics stores at concentrations around 40° Bè and at a very affordable price, used for etching microcircuits, and in chemical stores at better quality but much higher price. The former is equally suitable as the latter with the caveat of 'neutralisation,' which will be discussed in Appendix 1. It is always advisable to store a certain volume of liquid in a separate container at a higher concentration for topping up and dilutions. A table of $FeCl_3$ densities/concentrations is helped in Appendix 3.

3) You need at least 4 baths at decreasing densities as mentioned below. Moving the plate to and fro between baths (see below) and basin agitation are used too, to match the correct etching times.

(4) The permanence of the copper in the baths and biting times of the single steps are also conditions to be personally evaluated so as to obtain the correct reproduction range in density. The overall maximum etching time is less than 30 minutes for bitumen grains resistance with respect to their lateral undermining.

(5) *Acid penetration into gelatine is evidenced by a colour change on the plate; its surface changes from proper own colour to a very dark brown. The change occurs quite gradually and can be appreciated with some experience, since also* $FeCl_3$ *has a brick-red color! The values given here are a start you can trust.*

6) The degree Baumè (shorthand °B or Bè) is a practical unit for measuring the density of liquids more or less dense than water. Density is associated with the concentration of a 'solute' in a 'solvent'. (APPENDIX 3)

(7) The temperature coefficient (i.e., the change in density / concentration due to change in temperature of the liquid) is ***1°Bè/3°C****, i.e. three degrees deviation of temperature makes change – up or down – one degree Baumè in density. Since aerometers as most immersion instruments are calibrated at 15°C, in case our liquid is 21°C, the real value will be 2 Bè more (a 21°C solution in which the instrument reads 38°Bè, corresponds to a real concentration of 40°Bè at 15°C, since liquids loose density as temperature rises). BUT all this goes under the carpet when working with baths at room T around 21°C; at this temperature in fact the strength of the* $FeCl_3$ *onto the copper plate is equal to that of 38°Bè!*

The dilution coefficient (i.e. the change in density of the liquid by addition – or evaporation – of water in the solution) is worth ***1°Bè/40 cc/ lt****, i.e. 40 millilitres of water added to one litre of solution lowers its density of 1° Baumè.*

(8) Conversely, when speed is too fast (daresay less than 2'/ 0.1 D) we will put back the plate to the previous bath. If this is the first bath, we stop agitation and reduce visual inspection, to avoid any renewal of liquid on the plate surface.

(9) Diluted acetic acid acts as a weak acid against the stronger $FeCl_3$ *neutralising the etching action on copper.* $NaHCO_3$ *is a 'buffering salt' capable of neutralising both acids and bases. The former has an unpleasant smell in handling operations; the latter is cheap, harmless and the reaction produces only fizzy* CO_2*. Good for hungover too.*