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COLLODION PHOTOGRAPHY

July 2020

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J a n   S t r i j b o s

Dromen # 2

Chapter I

History

The oldest permanent photograph with an image formed in a camera was taken by Nicéphore Niépce (1765-1833). He was looking for a way to use photosensitive bitumen to improve lithography and in 1822 he laid the foundations of heliography (= drawing with light), a method of transferring line drawings onto an engraving plate.

Nicéphore Niépce
(1765-1833)

the very first photographic image
1824

In 1824, he succeeded in taking his very first photographic picture with the same technique. The image was taken from his office window.

After a long exposure in a camera obscura (eight hours, but perhaps several days), the bitumen was sufficiently hardened by exposure to light to allow the removal of the uncoated part with a solvent. This resulted in a positive image with light areas corresponding to the cured bitumen and dark areas corresponding to the bare areas where the solvent did remove the bitumen.

It is known that over the following years, several researchers conducted separate research to capture an image with a camera obscura.

As for Niépce, he concluded a partnership with the French researcher Jacques Louis Mandé Daguerre (1787-1851). After Niépce's sudden death in 1833, Daguerre continued their experiments.

In 1839, the invention of photography was announced almost simultaneously in France and Great Britain. But in fact the two working methods were quite different.

The daguerreotype, named after Daguerre, gave a unique positive image on a silvered copper plate.

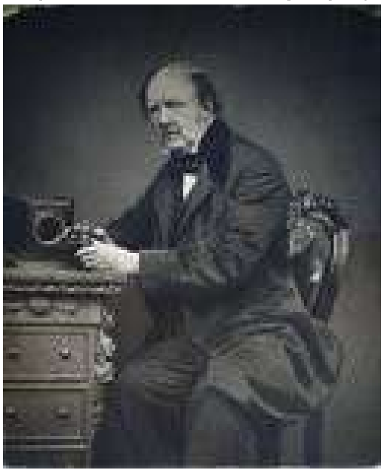
Jacques Louis Mandé Daguerre
1787 – 1851

The calotype, developed by the British William Henry Fox Talbot (1800-1877), produced a negative image on paper, allowing an unlimited number of positive prints to be made. Both inventors emphasized the many possible fields of application and the great usefulness for science and education of this new technique. Precise and relatively fast, photography was not equalled at the time by any other image recording technique.

However, the success of photography was hampered by a number of imperfections that would not be eliminated until some years. The images obtained through daguerreotypy could only be multiplied by converting them into one of the traditional graphic techniques such as lithography or engraving. But by doing so, the most important characteristics of the photographic image were lost, namely its extreme detail and undeniable authenticity. The direct engraving of the original daguerreotype plate could only partially remedy this.

The calotype, which could be reproduced without limits, proved to get very easily discoloured and could not withstand prolonged exposure to light.

Successive improvements to W.H. Fox Talbot's original process, however, brought photography on paper out of its experimental stage around 1850, so that by 1855 the daguerreotype was almost completely obsolete.



William Henry Fox Talbot
1800 – 1877

Christian Frederick Schönbein
1799 – 1868

In 1845, Christian Frederick Schönbein, a German-Swiss chemist, accidentally discovered nitrated cotton (fulmicotton, nitrocellulose), i.e. cotton fibres soaked in a mixture of sulphuric acid and nitric acid and highly flammable.

One year later, in 1846, Louis-Nicolas Ménard (Fr) and Florès Domonte discovered that by dissolving less strongly nitrated nitrocellulose in ether and alcohol, a clear, relatively strong and gelatinous liquid was obtained.

In 1846, a Boston physician, John Parker Maynard (USA), developed a formulation of this gelatinous liquid that made it possible to apply a sterile layer as a kind of liquid wound dressing.

The solution was called "collodion" (from the Greek kollodis, sticky).

Maynard's discovery led to a number of commercial forms of this liquid and the liquid/flexible collodion is still used today as make-up for special effects (scars...) or in the medical world to fix sensors on the body.

The first person to suggest the use of collodion for photography was probably the Englishman Robert Bingham in his book *Photogenic Manipulation* (1850). He was also one of the first photographers to use and later describe the collodion process.

Gustave Le Gray (Fr) published the first iodized collodion formula in his "*Traité pratique de photographie sur papier et sur verre*" (Publisher: Paris: G. Baillière) in 1850. But his formula was mainly theoretical.

The English sculptor/photographer Frederic Scott Archer used collodion in his experiments to make paper negatives by coating the paper with collodion impregnated with silver iodides, but because of problems encountered when coating the paper, he eventually replaced it with glass plates.

Gustave Le Gray 1820 – 1884

His aim was to be able to detach the collodion layer and to use it as a transfer to obtain a positive image by contact printing. His attempts were unsuccessful because the layer was too fragile. He therefore chose to keep the glass plate as a fixed support.

The first detailed description of his process, with tested and functional formulas, was published in *The Chemist* of March 1851.

The bromide and iodide salts were dissolved in the collodion.

In 1851, Archer used only collodion combined with potassium iodide, but dozens of other recipes can be found. Only the iodides and bromides of potassium, cadmium or ammonium did work effectively. Iodides are used for their sensitivity to light, and bromides for the range of tones they can produce.

The collodion mixture is poured onto the glass plate. The glass plate is then placed in a silver nitrate solution, which converts the bromide and iodide salts into silver iodide and silver bromide.

This makes the emulsion sensitive to light.

Once this reaction is complete, the plate is removed from the silver nitrate solution and exposed in the camera.

After exposure, the plate is developed in a solution of iron sulfate, acetic acid, alcohol and demineralized water, after which the image can be fixed with sodium thiosulfate, ammonium thiosulfate or potassium cyanide (KCN).

As the collodion layer is very sensitive to scratches, a varnish will be applied to protect it, after the plate has dried.

The procedure described above is known as the wet collodion process, because the emulsion must remain wet during the process until it is fixed. Its sensitivity to light also decreases as the emulsion dries.

These glass negatives, once they have received a black coating (paint, paper, fabric) on the back to create a pseudo-positive image, become ambrotypes - named after their inventor James Ambrose Cutting.

Frederick Scot Archer, 1813 – 1857

He sealed the emulsion layer by placing a glass plate on top and gluing it with canada balsam. Subsequently, black lacquered tin plates were also used as a support, allowing an immediate positive image to be obtained.
These were called ferrotypes.

Making a reproducible photographic image in this way, either by printing the negatives by contact, or by applying a black background to get a direct positive image, was for the time fairly simple, cheap and less time-consuming than the other processes that existed and were used then – the daguerreotype and the calotype – and this also made photography much more accessible.

*   *   *

Chapter II

The wet collodion process

1. Cameras and lenses

In principle, any camera equipped with a back and a plate holder in which a 2 mm glass plate can be placed is suitable for collodion photography.

In older wooden cameras, the plate holders were used with glass negatives from 1½ to 2 mm thick. The same glass thickness is still used today for collodion photography.

But for wet collodion photography some additional aspects need to be taken into account.

The silver bath is very corrosive. As a result, the metal parts of the plate holders are quickly corroded and must therefore be well protected/maintained.

Give the metal parts a few coats of clear varnish, nail polish or even sandarac and dry the plate holder carefully after each photo.

The slightest grain of dust is immediately visible on the plates; use regularly an air dust blower to clean the plate holders.

Bare wood can get warped due to humidity. The slides may start to block. Again, make sure that these parts are well protected.

In terms of lenses, there are also many possibilities, even projector and magic lantern lenses can be used. Each lens has its own characteristics.

However, lenses without surface treatment are preferable, as some layers can filter UV light. Make sure you know your lens. Start and continue working with one camera/lens for now.

2. The support

At the time, the first collodion pictures were taken on simple clear glass. Later, blackened metal plates were also used: these were called ferrotypes. Nowadays, normal float glass of about 2 mm is generally used. This is a cheap material that can be found in any glass shop.

With thicker glass, the black layer is too far away from the picture and will give a strange image. Many materials other than glass can be used. Think for example of Plexiglas (black), Lexan, black glass, black powdered aluminum ...

Lexan and Plexiglas are easy to cut to size. Their advantage is that they are unbreakable. The disadvantage is that they are more sensitive to scratches and therefore less suitable for reuse.

Glass is very easy to cut with a good glass cutter and a cutting ruler. It is important that the plates are cut at right angles and to the right size.

After cutting, the sides are blunted by passing over them a few times with an abrasive stone.

After deburring, do not stack the glass plates on top of each other. There might now be very small splinters of glass on the edges.

By placing and moving them on top of each other, the glasses may scratch and this will show up in the final images. Always clean the glass with warm water and soap and wipe it with a regular kitchen towel. Put a piece of paper towel between the glass plates or put them in a dryer.

Just before shooting, the plate is cleaned again with a homemade glass cleaner (calcium carbonate) and a pure cotton cloth – twice. The glass plate should be rubbed until all areas are clean.

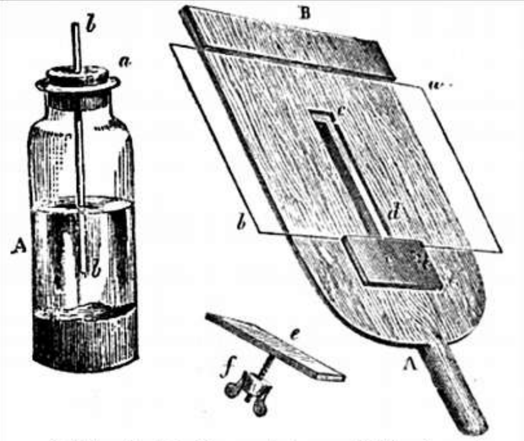
To do this, use black, non-powdered latex gloves so as not to leave fingerprints.

Take particular care not to leave any chalk marks.

At the end, fog the plate with your breath and polish the glass with a clean cotton cloth until everything is spotless.

Also thoroughly clean the back and sides of the glass to avoid problems with collodion adhesion. This cleaning also prevents contamination of the silver bath.

"Peeling" problems are often related to a plate that was not properly cleaned.



Bottle with tripolite, and glass polishing board

Glass cleaner formula :

1/3 calcium carbonate
1/3 alchohol 93 %
1/3 demineralized water

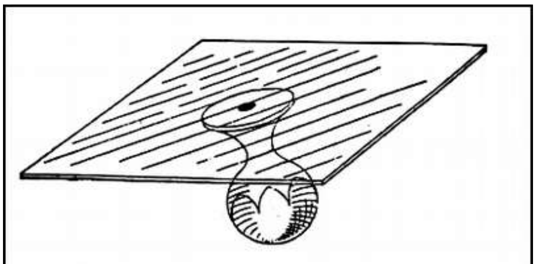
If you have not used the cleaner for a while, you will see that the calcium carbonate has settled to the bottom of the bottle. It is therefore necessary to shake the product well before using it. Also be sure to close the bottle tightly after use, otherwise the alcohol will evaporate quickly.

Quinn Jacobson *recommends putting the glass in an albumen bath before coating it with collodion. Then to let it dry for at least an hour.*

Albumen bath formula: *5,3gr powdered albumen (≃ the white of one egg)*
1000 ml demineralized water

3. Coating the plate

It is advisable to wear thin non-powdered latex or nitrile gloves throughout the process. This will prevent your hands from getting dirty, as well as getting fingerprints on the glass.


Suction cup and glass plate

There are 3 methods for pouring the layer:

1. glass plate on fingertips (serving tray)
2. hold the glass plate at an angle between thumb and forefinger (cantilever).
3. use a suction cup to manipulate the plate (especially useful with large glasses). See picture.

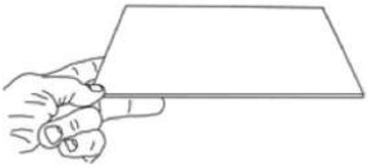
The advantage of the first and third method is that you can pour over the entire plate. With the second method, there will always be an uncovered angle (under the thumb).

Hold the plate as you wish and pour the collodion. The amount is a matter of experience; as a starting point, consider that you need to pour enough to cover about half of the plate.

Then allow the collodion to flow slowly towards the four corners. The last corner is always the corner from which the excess is poured into a collection bottle, with a back-and-forth movement of the plate. This avoids the formation of ridges during the drying of the plate.
Drying speed depends on temperature and humidity. In very hot weather, it may even be too fast. The plate may then show signs of drying at the edges and/or streaks in the image. This is a

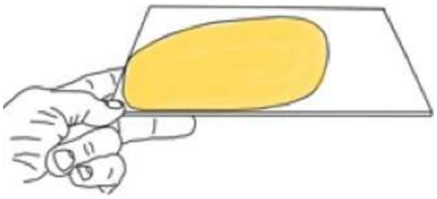
sign that the collodion could not flow properly. Adding alcohol may be a solution because it evaporates less quickly than ether.

A plate usually dries in about a minute. To check if a plate is ready, press with your fingertip on the angle from which you have returned the collodion to the collection bottle. If you can see a good fingerprint, the collodion is sufficiently dry and the plate can be placed in the silver bath.

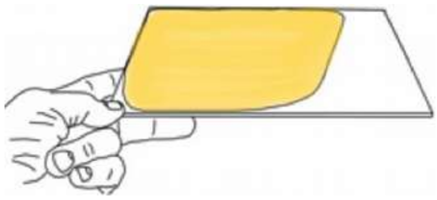


1. Keep the plate horizontal

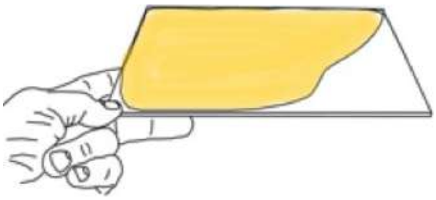
2. Pour collodion in the middle of the plate



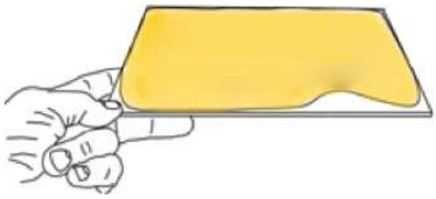
3. Tilt the plate slightly forward and to the left.



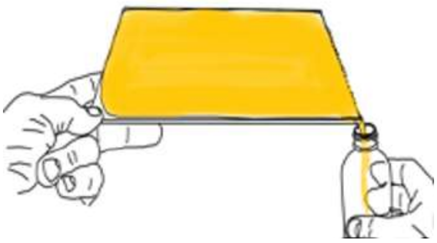
4. Tilt slightly backwards



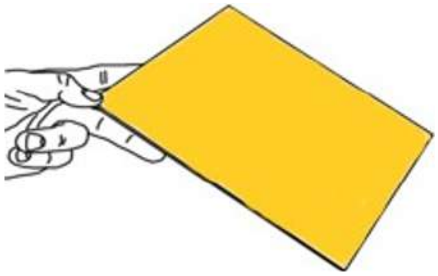
5. Then to the right



6. And finally again forward



7. Pour the excess into the bottle from the right front corner.



8. Move the plate with a back-and-forth motion

Formula → "New Guy" positive collodion:

1– IODIZER: A: 80 ml alcohol 96%.
80 ml ether.
Mix thoroughly the alcohol and the ether.

B: 3 ml demineralized water
1,5 gr. cadmium bromide.
2 gr. ammonium iodide.

Dilute the cadmium bromide completely in demineralized water first, and only then the ammonium iodide. Add this solution to solution A (alcohol-ether).
Shake the bottle until the two solutions are thoroughly mixed.

2– COLLODION: Collodion USP.

Before use: mix parts 1-Iodizer and 2-Collodion USP in following proportions.

Iodizer (ml)	Collodion (ml)	Volume (ml) salted Collodion
1,33	1	2,33
10	7,5	17,5
20	15	35
40	30	70
80	60	140
160	120	280
320	240	560
640	480	1120

This mixture must cure for a few days before it can be used. A "young" salted collodion can cause veiling if the solution has not aged sufficiently.

The recovered collodion can be reused after filtering and adding 10% of 96% alcohol and 20% of ether.

Young salted collodion: is yellow in colour, very sensitive and low in contrast.

Old salted collodion: is red in colour, not very sensitive and with high contrast.

4. Sensitizing the plate

Until now, all operations could be performed in daylight, but sensitization and subsequent handling of the plate must now be done in the dark or under red darkroom light.

Caution! The silver bath is very corrosive and a little of this liquid in your eyes can make you go blind. (safety glasses).

Put the coated plate in the silver bath in one movement. A hesitation during this operation will be visible in the picture at a later stage.

There are two ways to make positive collodions sensitive to light.

Method 1: Put the plate in the silver nitrate bath for 3 minutes.

Method 2: Remove the plate from the silver nitrate bath regularly and check for oily traces. When these traces have disappeared, the plate has been in the bath for a long enough time.

When it comes out of the silver bath, the plate will have a translucent opal white colour. Let it drain for 10 to 15 seconds before drying the back with a piece of household paper, then place it in the plate holder.

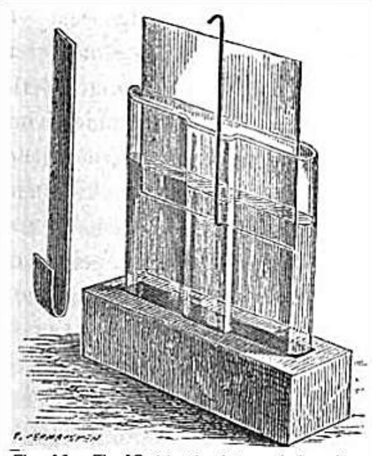


Fig.41 Fig42 Vertical tray (glass)

Formula for the silver bath :

90 gr. silver nitrate

1000 ml demineralized water.

pH of the positives: 2,5 - 4,5

Density ±1,070

Silver nitrate is dissolved in water and the acidity and density of the solution is measured.

The density can be adjusted, if necessary, by adding more water or silver nitrate. (pure water = 1.000)

The pH of the silver bath can be adjusted by adding nitric acid or sodium bicarbonate.

Do this very gradually (drop by drop); check after each addition. The silver bath must be filtered again after this addition of nitric acid or sodium bicarbonate.

If the pH is not acid enough, this can be done by adding a few drops of nitric acid.

The bath must be iodized before use. This is done by leaving a plate coated with positive/negative collodium in the bath overnight.

Always filter before and after use!

After frequent use, you can "sun" this bath.

This is done by placing the silver nitrate solution in a large container and covering it with absorbent paper. Put this container in the sun for a few days in front of a window. This way, the organic pollution is deposited while the ether and alcohol, absorbed by the collodion, can evaporate.

After this sunbathing, filter the solution several times so that it is completely clean again, and then check again the density. If necessary, add water or silver nitrate to restore the density. Afterwards, the pH should also be checked.

5. Putting the plate in holder

Make sure the plate holder is ready before removing the plate from the silver bath.

If you use inserts in the plate holder, make sure they are oriented correctly (portrait or landscape).

Now dry the back of the glass to avoid excess silver solution in the plate holder and possible contamination during shooting.

Be careful when placing the glass plate, the collodion is now very fragile.

Close the plate holder before loading it into the camera. It is wise to perform these operations in a dust-free environment.

6. Exposing the plate

Make sure that all camera settings are adjusted before sensitizing the plate. The time available for the entire procedure is limited, so proper preparation is essential.

From now on, experience will play a significant role. There is no exposure table for collodion. The exposure time depends on many factors: available light (indoor or outdoor), brightness of the lens, age of the collodion mixture, length of the bellows ...

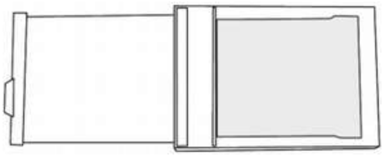
The easiest way to become familiar with the process is to start in a "studio" environment. This is the easiest place to manage and control the light.

Guidelines for determining your exposure time.

Your first shot!

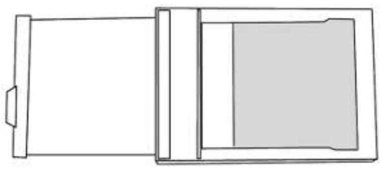
A first test can be made quite simply by using the plate holder. The light-tight cover slide makes it possible to make a test strip on a collodion plate.

1- Start by exposing the whole plate with a base time. This time depends on the amount of light and the adopted diaphragm.



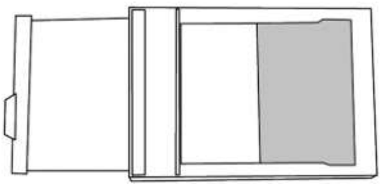
The plate holder is completely open.
The whole plate is exposed once with the chosen base time.
(Total plate exposure =1X Base time)
e.g. 10 sec.

2- ¼ of the slide is closed; the plate receives a 2nd exposure with the same base time.



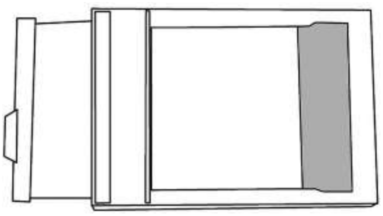
The plate holder is closed at ¼ .
The plate is exposed again with the chosen exposure time.
(Total exposure of the plate = 2X base time)
e.g. 20 sec.

3. Slide is half closed; the plate receives a third exposure equal to twice the base time.



The plate holder is half closed.
Plate is exposed a 3rd time with 2X the selected base time.
(Total exposure = 4X base time, or 2 f-stops)
e.g. 40 sec.

4. Slide is closed at ¾; the plate receives a 4th exposure equal to 4X the base time.



The plate holder is closed at ¾.
Plate is exposed a 4th time with 4X the selected base time.
(Total exposure = 8X base time, or 3 f-stops)
e.g. 80 sec.

Proceeding in this way, the collodion plate is given an exposure of 1X, 2X, 4X and 8X the basic exposure. This results in four strips, each with an exposure difference equivalent to 1 f-stop.

After development, the best exposure can be determined.

This technique is ideal if you are starting with a new camera or lens or if you have to work in unusual light conditions.

A collodion plate is sensitive to the ultraviolet region of the spectrum, a region that neither our eyes nor our photocell will detect. It is not sensitive to colours with wavelengths longer than green (red, orange and yellow).

It can be assumed that in a studio environment, the intensity of UV light increases in proportion to the intensity of visible light. This would mean that when the scene you want to photograph becomes brighter in the visible part of the spectrum, it would also become brighter in the UV part of the spectrum.

Once a correct exposure time for a first shot has been determined (see the test strip), the current light can be measured and the Exposure Index (EI) or Exposure Value (EV) indicated by the meter can be noted.

Your second shot, using the cell!

For a second shot, the incidence and/or intensity of the light may have changed. Therefore, we determine the exposure index (EI) or exposure value (EV) again.

The difference between the original exposure index and the new one gives the difference in light intensity between the two scenes, expressed in number of stops. This will be used to determine the new exposure values (f-stop and/or exposure time).

A change of one unit on the EI scale corresponds to a change of one f-stop or a doubling (or halving) of the exposure time.

For example, if the brightness of the scene changes by three EI units, then the lens aperture must be adjusted by three f-stops, or the exposure time must be multiplied/divided by eight – the equivalent of three f-stops – or a combination of both must be used.

This method of measurement often avoids a lot of trial and error and allows the correct exposure time to be obtained more quickly.

The best results are obtained with continuous lighting.

Different light sources can be used. Nowadays, "daylight" lamps are also available as energy-saving lamps. Apart from the fact that they have a nice colour temperature (5000 to 6500° Kelvin), these lamps also become much less hot.

Outdoors, the environment is much less controllable. The amount of UV light determines the exposure time. In the morning and in the evening, there is much less of it than around noon. The seasons also have an influence.

As the amount of light outside is often more intense, we will have to take this into account and to adapt the aperture of the lens accordingly.

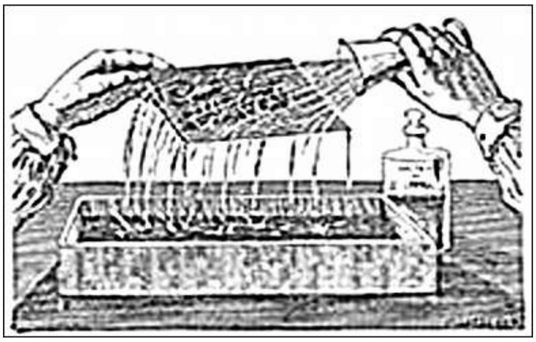
7. Development

Once the plate is exposed, we'll develop it.

The developer must be prepared in advance, ready for use in its small container.

Under red darkroom light, take the plate out of the holder and hold it at an angle of 10 to 15 degrees. In the other hand, grasp the container with the developer and pour the contents in a single fluid movement from the edge over the plate.

Make sure that the entire plate is covered and hold it horizontally now. Then gently tilt the plate from side to side to allow the developer to flow smoothly onto the plate. Parts that are not covered, or imperfectly, or late, will show defects on the plate.



The negative image will appear slowly: the silver bromides and iodides are now chemically converted to metallic silver.

- Within 3 to 5 seconds, the highlights (the dark parts) will appear;
- within 7 to 10 seconds, the middle tones will appear;
- about 15 seconds later, the shadows (light parts).

If the progress is much faster, that means the plate was overexposed. You can always try to save the plate by rinsing it out quickly, but this is only a workaround. If the progress is too slow and you prolong the development, the image will be eaten away and/or become grainy. There is only one remedy for this: clean the plate and start all over again.

If you have a good tone range within 15 seconds, you can immediately rinse the plate with plain water. Do this with a measuring glass in which there is enough water. The quantity depends of course on the size of the plate, but for an 18 x 24 cm plate you need at least one liter. The development is well stopped when the water remains in a nice even layer. Do not save water and make sure that all the developer is removed. Also on the back! It will be finished when all the "grease" has disappeared from the plate.

Always try to respect the basic development time of 15 seconds and stop before the shadow details become visible. If necessary, the exposure time will have to be changed. If the temperature rises, the developer will also become more active. A possible solution is to dilute the developer with more water, reduce the amount of iron sulfate or add sugar.

After rinsing, place the plate in a container with plenty of water. During rinsing, the image will also become slightly less dense. This is normal.

Formula for a positives developer :

T°<28°C		T°> 28°C	
20ml	alcohol at 96%.	10 ml	alcohol at 96%.
15ml	glacial acetic acid.	45 ml	glacial acetic acid.
500ml	demineralized water.	500 ml	demineralized water.
20 g	iron(II) sulfate.	20 g	iron(II) sulfate.

Mix alcohol, acetic acid and demineralized water. Then add the iron (II) sulphate and try to dissolve it completely. Let the solution stand for one day.
Filter before use.

To clarify the image, add about 10 ml of glacial acetic acid to 500 ml, or a few drops of nitric acid so that the pH increases from 1 to 2.

8. Fixing and rinsing

Now we are getting to the best part of the process, which is fixing. It is during this step that the final image will appear.
The most commonly used fixer is sodium thiosulfate (HYPO).

Thiosulfate acts a little slower than cyanide and is therefore more easily controlled.
Its use is much safer, the disadvantage being that it requires a longer rinse.
Hypo is less suitable for repeated use, but it is harmless to people and environment, and relatively cheap.

Formula for a sodium thiosulfate fixer :

300 g sodium thiosulfate.
1000 ml demineralized water.

Amaloco X89 (ratio 1/9) can also be used.

After fixing, rinse the plate with clear water and then with demineralized water. This will prevent lime marks on the plate during drying.

It is preferable to dry the plate immediately after rinsing. This drying is done on a drying rack or over a small alcohol burner (hand tolerable t°).

You will soon see the plate lighten a bit.

9. Varnishing

Warm the plate (not too much, so that it can be held by hand) to varnish it.

The varnish should be heated in a test tube above a flame, or in a pouring bottle kept in a water bath, to +/- 35 - 38 °C.

Pour the varnish onto the plate as explained for collodion. The excess varnish is poured into another bottle (collection bottle) to prevent dust from entering the pouring bottle.

After pouring, hold the plate at a slight angle. Do not make any back-and-forth movement. Allow the plate to dry a little. With your fingertip, you can carefully wipe off the edge where the excess has been poured back.

When the alcohol has evaporated a little, heat the plate above the burner. Keep the necessary distance between the flame and the plate. The alcohol evaporates immediately and you do not want a flame transfer to the plate. If this is the case and you have a "flaming plate": just blow it out.

When the plate is dry, you can place it in the plate drying rack. The varnish is very fragile. Let the plate rest for a few days to allow the varnish to dry further.

If you also use the pouring bottle as a surplus collection bottle, make sure to filter the varnish regularly to remove dust and dirt.

Varnish Formula

60g sandarac
400 ml of 96% grain alcohol
40 ml of lavender oil

Dissolve sandarac crystals in alcohol, stirring regularly. It may take several days before the sandarac is completely dissolved. Grinding the crystals in advance will shorten this time. Proper filtering is necessary to remove all dirty residues.

Then add lavender oil to the filtered sandarac solution and mix thoroughly.

Finally, pour the lacquer into a small sealed bottle.

10. Finishing the back

Once the varnish has dried well, we can proceed to the finishing of the back. A black layer must be applied to it to obtain a positive image. There are several possibilities for this:

For a plate to be framed, a piece of black cloth (velvet) or black paper will suffice. The darker the black, the better the result.

For a "free" plate, the back will have to be painted black. This can be done with a simple deep black acrylic paint.

Clean the back of the plate with alcohol. Then take a foam roller and the black paint of your choice and paint the back. For a good result, two coats should be applied a few hours apart so that the paint can dry well.

11. What to do if there is a problem?

Problems are usually due to chemical causes or technical errors. Many problems can be avoided by working precisely and cleanly.

Over-exposure: Exposed for too long, the image appears very rapidly during development.

Solution: shorter exposure

Under-exposure: Under-exposed, the image does not appear or appears only faintly during development.

Solution: expose longer.

Fogging and scumming: Often caused by overly long development or when developing at high temperatures. A gray haze will appear on the image. This is due to the development of the unexposed silver salts. It can be carefully removed with cotton wool when rinsing.

Solution: Shorten the development time, dilute the developer, or use a less active developer.

Oyster/Oyster stains: These "oyster-shaped" stains are caused by impurities on the plate. Generally, these stains can be removed with a cotton swab during rinsing.

Solution: Work more cleanly.

Developer sweeps: caused by the fact that the developer is not well distributed on the plate at one time, so that part of the plate is not developed.

Solution: improve your development technique and/or add more alcohol to the developer.

Ridges: usually created when the collodion is poured into the collection bottle. Either the plate was not moved hard enough or there was too little solvent in the collodion.

Solution: improve your pouring technique and/or add alcohol/ether to the solution.

Comets : comet-like shapes on the plate. These can be caused by contamination of the collodion and/or developer and/or silver bath.

Solution: good filtering and maintenance of the baths.

Peeling and lifting: the collodion layer comes off the glass plate. This can be due to contamination of the plate, and/or poor pouring technique, and/or placing the plate too quickly in the silver bath.

Solution: Clean better, improve your pouring technique and wait longer until the collodion has adhered well to the plate before putting the plate in the silver bath.

* * *

Chapter III

Chemicals

1. Precautions and points deserving special attention

Silver nitrate : Toxic, corrosive (burns the skin at the concentrations used here), it causes black spots on almost everything it touches (except glass, stainless steel and acrylic).

Ether : Highly volatile and explosive, flammable. Possibly carcinogenic.

Cadmium bromide : cadmium is the most dangerous of the metal salts we use and is highly carcinogenic. Avoid physical contact and inhalation.

Use all chemicals with caution. Make sure you have a safety data sheet/description for each chemical present in your lab.
Please pay attention to the information on these sheets. Wear gloves, goggles and a adequate mask (not just a painter's dust mask).

The acetic acid contained in the developer, if used in open baths for large plates, is very irritating to lung tissue and can cause damage to the respiratory tract.
Be sure to wear a good mask.

2. Products *(source: https://en.wikipedia.org/wiki/Portal:Chemistry)*

Ethyl Alcohol 96% (Éthanol) denatured with 5% methanol:
CAS: 64-17-5

Alcohol is used in collodion, developer, varnish and lens cleaner. It can also be used in the alcohol lamp.

Highly flammable. Store in a tightly closed bottle in a fireproof storage area. Keep away from fire.

Ammonium Iodide:
CAS: 12027-06-4

Ammonium iodide is a "salt" used in the collodion process, which mainly affects the light sensitivity of the collodion-silver nitrate solution and the image contrast. Exposed to air, it gradually yellows, but can still be used.

Always use a mouth mask and gloves! Store in a cool, dark place.

Mainly used in collodion formulas to be used quickly. ("Quick clear").

Ammonium Thiosulfate:
CAS: 7783-18-8

Ammonium thiosulfate is a fixer, which dissolves any remaining (unexposed and undeveloped) silver nitrate. This leaves only a developed image, made of pure silver, which is insensitive to light. It works faster than sodium thiosulfate but requires a longer rinse.

It is a safe fixative; concentrated, it gives a warmer tint to the image.

Acetic Acid:

CAS: 64-19-7


Do not store acetic acid or other acids in the vicinity of potassium cyanide (formation of the very dangerous "hydrogen cyanide gas").

Acetic acid is used as a chemical restrainer in the developer. It slows down and weakens the reaction of the iron sulfate and thus prevents the formation of deposits and fogging.

This fogging is the result of the development of unexposed silver iodide. In summer you need more acid than in winter because the heat boosts the developer.

Acetic acid freezes at 16°C already but can be reused after thawing, as this does not affect the chemical strength of the liquid.

Cadmium Bromide:

CAS: 7789-42-6

Cadmium bromide is a "salt" to be dissolved in the collodion, that will mainly influence the tonal range of the image.

It is a very dangerous chemical that belongs to the group of heavy metals. Harmful by inhalation, absorption through the mouth and skin contact. When ingested, it does not break down and affects organs, which can lead to cancer or death. Always use a mouth mask and gloves!

Cadmium bromide combined with silver nitrate gives silver bromide, which gives a light yellow colour to the plate after the silver bath, and is known for its light-sensitivity.

Calcium Carbonate:

CAS: 471-34-1

Calcium carbonate mixed with alcohol and demineralized water is used for polishing glass plates. We know it as limestone or chalk. When polishing, very small scratches are made, which will also improve the adhesion of the collodion to the glass surface.

Collodion USP – 4% :

When buying collodion, don't forget to look at its composition. It should contain approximately 65-75% ethyl ether, 20-30% alcohol and 4-8% nitrocellulose.

When mixing the collodion, add more alcohol and ether in order to get a ratio of about 50% in the collodion to be used. This addition improves the viscosity and adhesion of the collodion. In hot weather, the collodion also dries out less quickly. Unopened collodion can be stored for a very long time. For open collodion, it is recommended to use it within one year. Store the collodion in a cool, dark room, away from sources of ignition. After each use, close the collodion bottle airtightly to prevent evaporation of alcohol and ether.

Ethyl Ether :

CAS: 60-29-7

Ether is a volatile liquid that, under certain circumstances, can lead to fire or explosion. Ether should be stored as much as possible in a cold, dark, air- and light-tight room. Ether can be stabilized by mixing it with alcohol to neutralize the risk of explosion. Ether should be stored and handled away from sources of ignition.

Ether is used in the collodion process as a solvent/diluent and to prevent the formation of lines in the collodion during coating. Excess collodion collected can be diluted again with an ether/alcohol solution to regenerate it.

Iron (II) Sulfate heptahydrate:
CAS: 7720-78-7

This is the main component of the developer. It has a light green colour and a sweet smell. In its pure form, it can be stored for a very long time. It converts exposed silver halides (silver iodide) into pure metallic silver.
It is an aggressive developer: without diluting or addition of a restrainer, unexposed silver halides would also be transformed, resulting in a blurred image (fogging).
The strong action of iron sulfate in the developer can be limited by the addition of an acid. Acetic acid is generally chosen, although other acids are also considered.
By adding some alcohol, the developer will spread more easily and evenly on the glass plate, especially in hot weather.
The developer turns red when stored, but it is certainly still usable, although some people choose to make new developers all the time. Obsolete developer seems to decrease in power but seems to increase brightness .

Lavender oil:
CAS: 8000-28-0

Added to the solution of sandarac and alcohol to maintain its elasticity; without it, the varnish layer will end up with small cracks due to drying out.
It is necessary to use a real oil and not an extract.

Sandarac:

Sandarac gum (or sandarac) is a resin obtained from the small conifer Tetraclinis articulata. It solidifies when exposed to air and comes in the form of small solid yellow bits. Morocco is the main place of origin of sandarac. Dissolved in alcohol, it gives a very sticky liquid which is used to varnish the plates and, after drying, to protect the fragile layer of collodion.

Sodium Thiosulfate:
CAS: 7772-98-7

Sodium thiosulfate is a fixer. It dissolves all the remaining silver nitrates (unexposed and undeveloped), leaving only the developed image, which is pure silver and insensitive to light. Sodium thiosulfate is slow-acting and requires a long rinsing time. At a concentration of >20 %, a more traditional black/white tint is obtained. A higher concentration of 20-40% will produce warmer tones.

Silver Nitrate:
CAS: 7761-88-8

Silver nitrate is the silver salt of nitric acid. Also called hellstone, it comes in the form of colourless, clear crystals. On contact, silver salt penetrates the skin, which darkens under the action of light or antioxidants. Direct contact is strongly discouraged, gloves and glasses are certainly not an unnecessary luxury. Immersed in silver nitrate, the collodion plate will become sensitive to light. After this silver bath, plates must be handled under red darkroom light.