Gum Bichromate

(For use by beginners and others)

I) Origins of the process

On the French side, it was Alphonse Poitevin who used the property that bichromate possesses for rendering gelatine insoluble after exposure to light. It was in the 1850s that he developed his research which led in 1855 to the improvement of the charbon process.

On the English side, it was John Pouncy who presented some prints to the London Photographic Society in 1858. The process was not an immediate success because of the absence of intermediate tones.

Robert Demachy (1859-1936) was one of the first to apply the gum bichromate process in around 1894. He was to become one of the leaders of the" pictorialist" movement. He considered that photography should be interpreted: "Does a photograph have to be produced only by mechanical means or can we admit that we call upon the artist's talent and skill to modify it?"

He formed part of the movement that opposed those who think that photography must be the means of capturing and recreating reality and nothing but reality. Like all pioneers, he experimented and contributed to proving the worth of photography. He took part in the production of the text: "Le procédé à la gomme bichromatée ou photo-aquateinte "[1]. He was well-known abroad, in Great Britain and in the USA. Stieglitz bought several of his photographs and devoted a portfolio to him in 1904 in his magazine: "Camera Work".

Demachy not only worked with gum. He experimented a lot with other processes. His most well-known pictures are his portraits and those of the woman's body on which he plays with gum and colour. In 1914, he stopped all photographic production, no one knows the reason for this. He left most of his works to the "Société Française de Photographie » and to the "Royal Photographic Society".

In his book, he explains his method clearly and gives numerous details on his choices and his experimentation. It is a good basic text with which to understand the process because it is aimed at beginners. Nevertheless, the work remains difficult until you have actually seen a gum being carried out. That is the reason why, I'll simply go over the stages which must not be missed out, recommendations which were lacking during my first attempts.

II) Advantages of the process

It is a means of intervening directly onto a picture, giving it a personal interpretation.

Above all it is a process which gives the opportunity to work with both artists' and photographers' tools: paintbrushes, pigments and negatives. The resulting image remains stable if a few rules concerning the quality of the paper and the products used are respected.

In short, it is a composition of pictures obtained by successive superimposition of each coloured layer. Each of these layers must then be exposed to light and developed in a

[1] Written in co-operation with Alfred Maskell in 1898, this text has been republished at Jean-Michel Place Publishings, « Résurgence » collection.

tank of water. Each development[2] is carried out using a range of personally–selected tools. This constitutes a phase of undeniable creation and thus of interpretation. It is clearly with development skills that the remarkable character of the gum bichromate appears far from mechanical movement and infinite reproduction.

III) Process Implementation.

Just mix some pigment or tubed water colour in a solution of 35% arabic gum, sensitise with a solution saturated in potassium bichromate (9%), lay this mixture on a sheet of gelatinised paper, expose it under a negative, develop it in a tray of water at 20°C and if necessary intervene with a brush or a water sprinkler.

Everything has been said but a lot of information is lacking which would enable beginners to succeed in their first attempts. I will make do with a description of the pitfalls to avoid. To understand the technique in detail, I will refer you to Alain Gayster's comprehensive text published in the first issue of Hélios' newsletter.

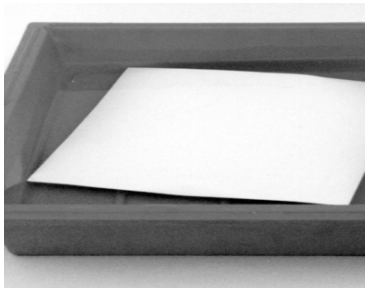
My process, therefore, consists of saving time for beginners and above all to avoid discouraging them. My explanations are given according to the necessary stages for the production of a gum.

A) Choosing the right paper

The choice of paper is essential for a good preservation of the prints. You must choose a non-acidic paper. The paper said to be permanent is manufactured under the ISO 9706 standard. The pH must be between 7.5 and 10. The alkaline reserve must be higher than or equal to 2% of the equivalent amount of calcium carbonate. The symbol is the encircled mathematical sign for infinity with the reference ISO 9706[3]. I use the paper Vinci (350gr) of Fabriano's which is highly white without acid and doesn't retract after several immersions in water. The Velin Rives BKF and the paper Lana Royal 250gr are also excellent papers.

B) Preparing the paper

Three essential steps:



1) plunge it into water at 60°C for half an hour th en hang it up.

2) gelatinise it with photographic gelatine or failing that with gelatine used in cooking. This operation is carried out by immersion or by using a paintbrush for the following formats: the Grape (raisin), Jesus (Jésus), big eagle (grand Aigle) and Great world (Grand Monde). I prefer the former operation because the resulting layer is more regular.

In both cases I use the following formula: for 1000 ml

[2] The development is the action of water on the exposed layer. The areas on the picture hit by the ultraviolet beams through the clear parts of the negative will become insoluble and will remain visible on the paper. The other parts will dissolve in water. It is always possible to intervene with a brush.

[3] Read the article by Astrid-Christiane Brandt : " Le papier des XIXe et XXe siècles menacé. " in : Les Cahiers de médiologie N°4. Gallimard, 1997.

900 ml of distilled water
40 gr. of castor sugar diluted in 100 ml of hot water
60 gr. of gelatine.

I leave the gelatine to swell for a few hours before melting it over a bain-marie. Each sheet is then submerged in a tray of gelatine which is maintained at a temperature of between 35 and 40°C with a hotplate. In the case of using a paintbrush to spread, for a Grape format, I use a syringe. I pour 25 ml of gelatine heated at 40°C over the bain-marie from the centre to the edges of the sheet.

I then smooth the gelatine with a large brush to remove the streaks formed by the pressure of the paintbrush. In order to prevent the gelatine from setting too quickly while cooling, I stretch it onto a sheet of Plexiglas, which has been put over a large tray filled with water at 65°C, so as to heat the sheet. When the spreading stage is finished, I furtively pass the sheet 40 cm from a bluish flame to melt the gelatine and to avoid streaking.

Next, I dry the sheet in a cool place so that the gelatine sets quickly. The difficulty with using a brush, arises with the formation of micro bubbles, which in drying induce imperfections when spreading the layer of gum. I noticed that, by preparing 2 litres of gelatine, this phenomenon was a lot less present. You have to take the sheet out of the tray of gelatine holding it by the two top ends and by checking with a low-angled light that no micro bubbles have formed.

3) The gelatinised paper is plunged into a tray of formalin at 3%. This operation must be carried out in a well-ventilated room or in a garden[4]. To prevent the evaporation of the formalin, I cover the tank with a sheet of Plexiglas. Each sheet is submerged for a maximum of 4 minutes[5] and then rinsed in a tank of clear water. The tray of formalin can be used for about fifteen sheets in the Grape format.

Gelatinising and hardening are essential to prevent the pigment becoming impregnated on the paper at the first layer stage and thus rendering development impossible.

C) Choosing pigments.

Always try to use high-quality pigment. I began with Sennelier's three primary colours and lampblack. I also use Luccas' pigment, available from "La Comptoir des Artistes"[6].

The quality of the pigment is essential as is knowledge of their resistance to light[7] for good picture preservation.

The quantity of pigment must not be excessive. I use scales which are accurate to a hundredth of a gram and I systematically weigh my products. To be sure of the maximum quantity of pigment, it is sufficient to spread on a sheet of newspaper the gum and

[4] It is imperative to wear gloves and work clothes because of the toxicity of the product.
[5] Whatever the size.
[6] Le Comptoir des Artistes, 6 bis, av Paul Langevin. BP 1051 95226 Herblay. cedex
[7] An excellent book by Gilles Delacroix and Marcel Havel : Phénomènes physiques et peinture artistique, Erec 1988

pigment mixture before the addition of the water and dichromate. If the prints can still be read through the colour, the quantity of pigment is sufficient, if not, the load is too thick and the pigment will block the ultraviolet light which won't harden the sensitive layer. Therefore, the gum will run during development.

In order to find the tones which have already been used, I have prepared a colour chart showing a range of shades with the addition of 0.05 gr of pigment. A good colour density can only be obtained with a minimum of two or three layers[8].
It is therefore important, especially on starting out, to make a note of each amount of added pigment.

D) Choosing negative density.

The negatives must not be over-contrasted, otherwise, it is to the detriment of intermediate tones. It is possible to produce two or three negatives in order to balance the areas between them and to avoid discrepancies of contrasts. For example, for a landscape, it is advisable to favour the sky on a negative and the rest of the landscape on a second and even a third if necessary. To produce my negatives, I use the Scala[9] slide. I take a print of this positive on a semi-shaded film at the required size. This avoids producing copies.

Another technique consists of printing only one negative and in making the exposure time vary in relation to the areas which are more or less light. The negative should not be too contrasted[10].

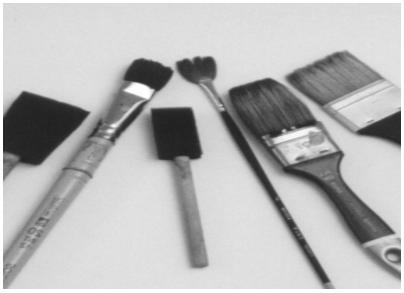
It is also possible to make masks with an overhead projector transparency by using red indelible felt-pens. Thus, the development is more accurate but it needs skill and patience.

E) Don't change all the parameters at the same time.

I either use ready-prepared gum[11] or I prepare my gum from lumps: 35 gr of gum for 65 ml of distilled water. I keep the solution in a fridge to prevent the formation of fungus. The basic formula is as follows:
1 volume of gum
+ pigment
+1 volume of distilled water
+1 volume of potassium dichromate (solution at 9%).

I use small 2ml quantities in small syringes. This amount is quite adequate for spreading two sheets measuring 13 x 18. The sheet is fixed onto a small plank of wood with self-adhesive tape. You have to spread a thin, even layer as quickly as possible, with the help of a short-bristled brush. I smooth it down while it is still fresh using a sort of fish-tailed paintbrush to get an even coat. I dry the sheet under a fan for about twenty minutes.

[8] For the colour: Robert Montchaud : La couleur et ses accords. Paris, Fleurus, 1994
[9] Manucfactured by Agfa. Sensivity 400ASA. Read the article published in : Le Photographe sept 98
[10] In her presentation, Marie-Louise Bréhant recommends the use of a laser photocopy to produce negatives
[11] Bought in stationer's shops



With experience, you see that, not only do you have to make the gum viscosity vary in relation to the pigment used, but also in relation to the number of layers applied. The first coats are more liquid and the last are richer in gum. I never vary the amount of gum, only the amounts of water or pigment. Depending on the colour of the pigment, it is the quantity of potassium dichromate that varies.

For example, yellow, unlike lampblack, is more sensitive to light and therefore needs a smaller quantity of dichromate or less exposure time.

F) Spreading sufficiently-runny layers

Especially for the first layers because the final layers can be thicker by halving the amount of water.

Robert Demachy had already pointed out that it was necessary to add water to make spreading easier. All the same, in many texts, it is specified that the coat layer has to be as rich as possible in Arabic gum. It is probably true if you work with only one layer, but I advise against it because the original feature of gum dichromate comes from the matter obtained from successive layers. Therefore, intermediate shades can easily be processed.

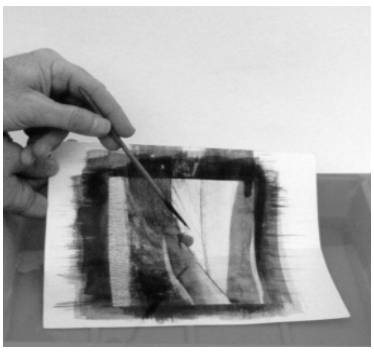
When I work with a more liquid mixture, the first layers are pale and the reproduction seems disappointing. It is sufficient to spread and to expose as many times as necessary to obtain the desired shade.

G) An adapted exposure system

I use two systems: in winter, two 125 W Philips HPR lamps (minimum required); in summer I work outside in the shade at the edge of a sunny area. I also work in cloudy conditions.

I require less time outside because the light intensity is higher than under the lamps. On average, exposure time is between 5 and 10 minutes. Everything depends on the density of the negative.

H) Developing at the right time



After exposure, the gelatinised sheet is put underneath in a tank of water at about 20°C. The work is carried out in daylight. It is essential to change the water for each layer so as to avoid an excessively-high dichromate concentration. The development can be passive when the picture develops on its own (sometimes for hours if it has been over-exposed) or it can be active if you use a paintbrush. You can delete whole pieces of gum and pigment saturated with potassium dichromate. Only certain selected areas will come to complete previous layers.

Gum dichromate is built by successive contributions of matter at each addition of a layer. It is not easy to decide on the deletion of a part of the picture especially if it even appears pale in its entirely. Moreover, this work is delicate, a simple clumsy movement can bring about the deterioration of the picture which can be repaired with the next layer. When development has been completed, the picture, still wet, looks magnificent, both shining and in relief, almost translucent.

The successive layers of colour stand out thanks to the combined effects of the water and the swelling of the Arabic gum.

The originality of this process is also due to the development technique, which consists of removing colour and in favouring certain areas, contrary to painters who work by the successive addition of material onto their supports.

Don't hesitate to intervene and remove all the parts which will later be coloured, with a paintbrush. My tools are numerous:
- a large syringe and a bottle of water to obtain a small water sprinkler.
- small, thin paintbrushes, such as those used for touching up in photography.
- a spray which is used as a high pressure water jet when the layer resists after over exposure.
- a hair drier. When development is complete, the hair drier allows at the same time fast drying and layer hardening so as to avoid dissolution at the next immersion in water.

I) Several successive layers

Even to make a monochrome, you have to plan at least three or four layers[12]. It is the matter, the transparency of successive layers, the thickness and also the intermediate shades which characterise the gum.

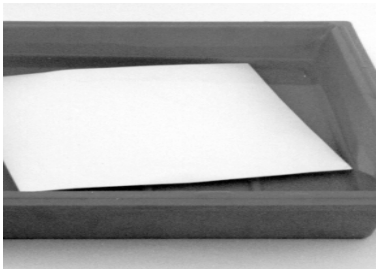
Working in multi-layers allows contrast and the possibility of bringing out highlights. I always begin with them and so I use light colours with little pigment. I make a long exposure.
I dry each coat with a hair drier, alternating hot and cold. Then I dry it in order to harden it. Sometimes I add a light colour on a dark background to obtain a greater transparency. On average, my gums consist of seven or eight layers, sometimes ten.

To locate the exact point on the negative, I mark the corners of the sheet of paper with a pencil when I position it on paper for the first time before exposing it. Then I locate the picture by transparency with an illuminated table after drying the next layer and just before exposure. Another method consists of drawing two crosses in the margin of each side of the negative with an indelible pencil, and covering the sheet with enough mixture. Therefore, when the development takes place the crosses will be used as reference marks.

Lastly, it is possible to perforate the film and the paper at the four corners with a pin and locate the places thanks to the illuminated table. Whatever the technique chosen[13], the location of the negative has to be very accurate because a smaller space will bring about a gap between the layers and therefore a blur.

[12] Monochrome multi-layers is a good exercise for beginners providing black is avoided as it has always been a difficult colour to work with.
[13] Alain Gayster in his previously cited article recommends the location with the help of a hole punch.

K) Do not forget to wash the final print



Not only with water but also with alum of potash (solution at 3%, heated at 40°C). The print is submerged in the solution for only three or four minutes. In that way, the potassium dichromate surplus is eliminated. It is even possible to intervene with a brush so as to do some touching up. The alum hardens the gum layers and whitens the paper.

The solution can only be used for two gums (format 18X24) because it is quickly saturated with potassium dichromate. The picture is then put in a tank of clear water at 20°C and dried on a clothesline. After drying, it is set between two pieces of photographic blotting paper and pressed. If the paper is not quite white you should start the operation again. It is always possible to whiten the picture in a bath of bisulphite at 5% but only for two or three minutes after the hardening, otherwise this product is inclined to dissolve the picture.

It is a way of working the gum. This practice, which is the fruit of a great deal of reading and several years' experience, can be improved and developed by each person. I have willingly separated the gouaches from the watercolours because I aim more for colour saturation than transparency. I am also seeking brush "rhythms" through the successive layers of gum. The technique affords infinite interpretations which each person can adapt to create their own images.

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Bourges on the 24 may 2001

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Translation: Mandy Brice – Claude Boutet

Recapitulative stages

Prepare the paper

Soaking ½ hour at 65℃

Gelatinising at 40℃ (6%)

Formalin (3%)

Spreading the first layer

1 volume of arabic gum

Addition of pigment (normally a light colour for the first layer)

1 volume of distilled water

1 volume of potassium dichromate

Spreading the sheet with a brush and smoothing with another brush.

Drying in the dark near a fan (for around twenty minutes).

Expose it

Postision the negative on the dried sheet and make location marks.

Sandwich between two panes of glass and use two large drawing clips.

Expose under lamps or outside in the shade.

Develop it

In a tank of clean water, the sheet turned towards the bottom

Work with a brush and leave only highlights.

Dry it

With the help of a hair drier, alternating hot and cold air. This action hardens the layer.

Second coat

Prepare the mixture identically to the first coat

After drying the coat for the second time, find the location of the negative in relation to the previously defined reference mark.

Then, the same operation as for the first layer: light, develop, dry and so on up to about ten coats reducing the amount of water for the final layers if necessary.