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Practical techniques of photographing by Lippmann's method used for making photos of solids and vapors spectrums.

(read on October 26 of 1902)

Making photos by Lippmann's technique remains quite a problem on which Lippmann, Valenta, Lumiere, Neigausen and many more have been working. However they haven't succeeded in resolving the problem totally. They have done a lot but there is still quite a job to make the technique possible to practice. Several years ago I started trying Lippmann's technique and reached some results. As not so many people have succeeded in resolving the problem I decided to describe everything I consider useful to know for improving the technique. I have shown my images to professor Lippmann. Having found the photos successful Lippmann decided to present them with his color ones to the members of international congress in 1900.

I should say that my success is due to a fluke so I think that the others who haven't got good results may be lucky some day. Proceeding with my work I decided first of all to make some experiments. To get fine-grained emulsion I used simple gelatin and got fine results from the first experiment. The electric arc spectrum colors were clear enough. This strengthened my confidence in the work I engaged in. Trying to provide the best conditions for reaching good results I bought Nelson's gelatin and thoroughly prepared the emulsion unfortunately I did not get color images on the plates.

Proceeding with my experiments I got colors but they were pale. I reached good results only when I used simple gelatin again. On my visit to Lippmann I emphasized that I reach good results only when using simple gelatin for emulsion. Then Lippmann showed me the gelatin he was using. That was simple gelatin.

Gelatin quality is very important for getting fine-grained emulsion that is necessary for receiving colors. I have my own method of getting plates with fine-grained structure.

I take 3g of simple gelatin cut it with scissors by thin stripes and put into a bottle having 100g of distilled water. I'm waiting for fifteen minutes while gelatin is getting sodden then heat it to 40°C in water bath. When the gelatin is dissolved it's I filter through filter paper.

I make two solutions:

A. Distilled water	100g
Potassium lower bromide	9.2g
B. Distilled water	100g
Argentic nitrate	12g

You may keep these solutions for a long time.

The gelatin solution is divided in two parts. I add 2.5cm³ of A. solution to one part and 2.5cm³ of B. solution to the other. After shaking up I gradually pour by small portions B. solution into the bottle with A. solution.

The mixed liquids should have temperature not higher than 25°C and you should mix them at red light. Take a few liquids from the bottle to the daylight and observe it. If the liquid is transparent you can pour it on the glass plates if not you have to make a new one.

Pour the emulsion on your glass plates and use them to get photos with color filter after ablation and drying. The emulsion may be orthochromatized to red, orange, yellow or green part of the spectrum. For this you have to do the following:

1. I got acquainted with photography methods reading "Les couleurs et la photographie" by Niewenglovski Amantl. Paris, 1985

2. Gelatin extra from Ferrein's drugstore

Make the solutions of:

A. Absolute alcohol	100g
Crystalline methyl-violet	0.1g
B. Distilled water	100g
Eosin	0.1g

Then pour them into emulsion of A. solution 9cm³ and B. solution 1cm³ and pour it on the glass plates. Take a thin simple or glass plates cleaned by caustic sodium, diluted sulphuric acid, clean water, ethyl alcohol and wear them through with towel with talc. Place the plates horizontally and pour the emulsion on them (about 5cm³ of emulsion to 9x12cm of surface). Spread it equally on the plate. Put the plates on marble slab adjusted horizontally and placed into ice bath.

When the emulsion gets frozen in 15-20 minutes remove the plates and place them vertically with 1cm distance in zinc machine and then put them into zinc bath with clean running water of temperature about 10°C. After 2-3 hours of abluion remove the plates from the bath and put them into outtake closet to dry at room temperature. Leave them there for about 24 hours then put back to the bath for abluion for an hour. Place the plates into boxes in the way that they face each other's emulsion side. Such plates may be kept up to one year without considerable damage. All stages of the process should be done at red light. It's better if the closet for drying be totally dark.

Preparing the plates for exposure

Before exposure the plates should be sensitized by placing it in one of the following solutions:

Absolute alcohol	100cm ³
Argentiac nitrate	0.5g
Crystalline acetic acid	0.5g
	or
Distilled water	100g
Argentiac nitrate	0.5g
Crystalline acetic acid	0.5g

Put the plate emulsion up in the bath with for two minutes. Remove the plates and take off excess water from them with flimsy. Planish the passing through paper and remove quickly the flimsy. Dry the plates 2-3 hours. The bathing causes constant chemical influence so it's very important to catch the right moment. Generally it's 2-3 hours after bathing. It has to be determined by experiment every time when using new plates.

The time of readiness of the plates depends also on the sensitizing solution concentration. You can successfully use it if want to increase the time past from bathing to development decreasing the concentration.

Exposure

Exposition is done in a mercury bath if you work in a laboratory if no use a special cassette. The mercury bath could be made as displays the image with a wooden frame fixed by screws on the legs. Put thin plate glass into the frame and fix it by Mendeleev's putty or sealing wax (image 1). Pour dry clean mercury into the bath. Before exposition place the plate into the bath by emulsion side to mercury and fix it on one of the walls by the other side. Such bath is good for laboratory studies and is preferred to cassette. If you work outside the laboratory use a cassette.

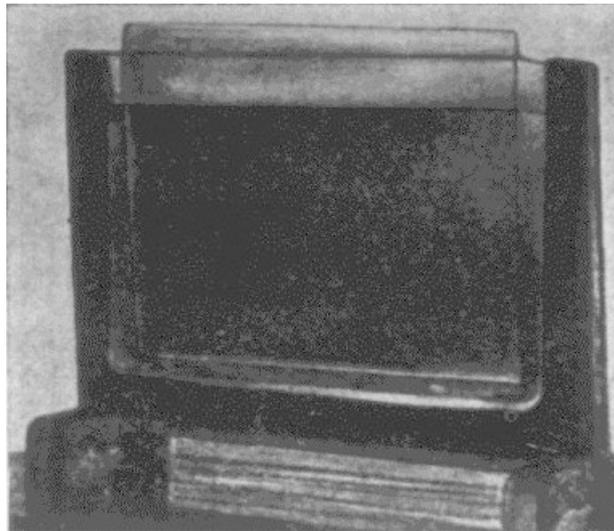


image 1.

Lippmann suggests the cassette made by himself (image 2,3). Image 2 displays the cassette from the side turned to into the camera: C – plate, D – frame pushing the plate, E'E'E'E – strains breaks H¹H²H³H⁴, M – bolt closing the cassette. Image 3 displays the profile of the cassette: A – reservoir in which flows all the mercury when it's in vertical position and has a plate inside, B – bolt that assure mercury flood equally on the plate that eliminates presence of oxygen bubbles between the walls and the plate, N – stopper.

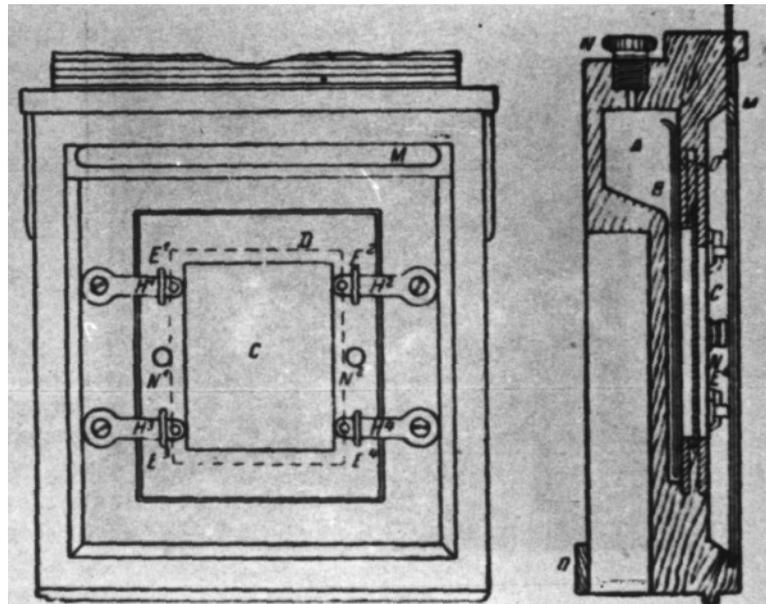


image 2.

image 3.

In a bright sunny day Lippmann makes landscapes photos at 1-2minutes. Complete spectrums from electric arc of 10sm length with 1.5 mm slit remain for 3-5 minutes. To get spectrums of metal vapors you have to keep it for 10 minutes. Non orthochromitized simply sensitized plates should be used with color filter partially detaining blue and violet rays. You don't need to use color filters with orthochromatized plates. Its sensibility is quite equal in all parts of the spectrum except red which can hardly be seen on photo. Using these plates for making photos of complex colors of lightened objects needs using color filters stopping extreme violet and ultraviolet rays which may be caused by solution of picric acid with distilled water or esculin alkaline solution. The solutions are placed in bath with parallel plate glasses under camera objective.

Lippmann states that it's enough for getting a good photo exposure for all hues of image colors. In Paris, 1900, I was lucky to see a series of perfectly done photos by Lippmann displaying views of Versailles and its flower gardens.

Development

Development should be done right after exposure as sensitizer keeps influencing the plate and may spoil it. Use the following developer:

A. Pyrogallic acid	0.5g
Distilled water	50g
B. Potassium lower bromide	10g
Distilled water	100g
C. Liquid ammonia with density 0.96 at 18°C.	

To 35 cm³ of water take lease:

- A. solution – 6cm³
- B. solution – 8cm³
- C. solution – 2.5cm³

You should make a fresh solution A. every day as it spoils after 24 hours. Development lasts 2-3 minutes. Leveling by development of over-expose and under-timed photos is almost impossible. Wash thoroughly the plate and place it into 5% solution of potassium cyanide in water for not more than 10 seconds. Right after that remove potassium cyanide with water otherwise the image gets pale. If your image is transparent in non-lightened spots and produced spots seem to be dark-brown if you look at the light through the plate it means the plate was not ready. In other words you should have kept your plate in sensitizer for some more time for it to influence the emulsion right. If your image got red-brown and has lighter spots where it was lightened and darker spots where non-lightened it means the sensitizer has spoiled the image. Good image should have yellow-brown color in spots you look through. In reflected light these spots should be smoky-colored. At reflected light or passing through the produced spots should have brown color.

(Can anybody say it is not a perfect criterion of optimal hologram processing!?? Sogokon A.B.)

Image dried at reflected light should reflect the color it has been influenced by while being exposed but only if the conditions of sight are the same as at photographing. As the light rays fell perpendicularly at the image at the moment of photographing the colors reflected from the image could be seen well if the light falling at the image reflects perpendicularly too. Under different angles of sight we can only see colors of shorter waves. For example red color may be seen yellow or even green. In fact a photo made by Lippmann's method can't give a natural color image. It will be natural only if projected on a screen when colors don't depend on sight angle. When watched directly from plate or projected on screen the glass gelatin surface of the image plentifully reflects white color besides colors of the object therefore the image gets pale. To get bright clear colors you should eliminate white color reflected by plate. For this put a prism (5°-8° angle) on gelatin surface. You can eliminate air between the plate and prism by smearing the surfaces with petroleum butter or Canadian balsam. It is significant that violet and light blue colors are absorbed inside the gelatin layer what has never been noticed with red or orange colors for which the plate is almost transparent. Therefore a complex color consisted for example of red and blue colors will undergo a change due to partial blocking of blue rays. To avoid this defect I have to make a plate transparent for all colors. I put the plate into a 5% solution of sublimate in water. Then I wash it in clear water and dry. After that it becomes transparent and gives supplementary colors if watched on passing light. If examining the image for example a sun spectrum in reflected light through a spectroscope we'll see a bright color line. Its color will be changing according to which part of the image the spectroscope will be aimed. If examining

the plate in a spectroscope on passing light we'll see a spectrum with a dark line of absorption. That line will move through the spectrum if you move the image before the spectroscope slit. These observations may be used in researching the quality of emulsion as the smaller are the grains of emulsion the sharper is the line of absorption or reflection seen in spectroscope.

Translated by Borozniak Evgeniy