THE

CANADIAN PHOTOGRAPHIC JOURNAL.

DEVOTED TO THE INTERESTS OF THE PROFESSIONAL AND AMATEUR PHOTOGRAPHER.

VOL. V. TORONTO, SEPTEMBER, 1896. NO. 9.

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Canadian Photographic Journal

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PUBLISHERS.....

The Nesbitt Publishing Co., Ltd.,

Rooms 97, 98, 99,
Confederation Life Building.

TORONTO - - - CANADA.

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LIPPMANN'S METHOD OF COLOR PHOTOGRAPHY.

At the Royal Institution recently, M. Lippmann gave a most interesting lecture on "Color Photography," and a demonstration on the screen of some of the results.

He described his plan as the "interferential method," and it is performed by one exposure only, and any film can be used and developed in the ordinary way. The only addition to the dark side of the camera is a mercurial or silver backing to act as a reflector. When this announcement was made, the audience were enthusiastic to a degree, and no wonder, for the charm was in the simplicity of the invention. As the most convenient, he arranged his dark slide with an extra space, and, when the plate is put in position, a valve allows the mercury to flow down behind it, and forms a perfect reflecting surface. The photographic film is exposed with the glass side to the lens and light, and when developed with acid or alkaline developer, and fixed with cyanide of potassium, the natural color can be seen by reflected light. It is necessary to so hold the photograph that these reflected rays fall on it in the proper position, as otherwise it is only black and white as used in a negative or positive. A dark backing is also required to the photograph.

Several photographs taken by this method were projected on a small screen, and to do this an electric opaque lantern was employed, the operator fixing the subject on to a rod that permitted it to be turned so as to get the color from reflection of the incident rays. Among the subjects were a stained-glass window; a lawn, with lady sitting on a chair, and having a background of trees; a house illuminated by sunlight, with climbing plants on the walls; a mansion with tower and garden; groupings of flowers and fruit, and a gaily colored parrot. It was stated in respect of the flowers taken in sunlight that a three minutes' exposure was given.

M. Lippmann, in his explanation of the results obtained by this process, used the phonograph for a simile or

analogy, and said his opinion was that, as sound waves are inscribed on the phonograph diaphragm, so light waves were impressed on the film after reflection. A simple and telling experiment demonstrated to the audience that waves are both direct and reflecting, and at certain positions, where the two sets of waves meet, there is what is known as standing waves. A long india-rubber tube, attached near the ceiling, was set in motion from the floor, and the waves ran up to the top, and then returned in complimentary waves. By increasing the motion loops were formed of these waves, and at definite intervals there was no motion. The mercury reflector sent the waves of light back, and at half-wave lengths of the incident rays the colors of those rays proceeding from the object were impressed on the sensitive film.

The interference of light was well shown by making a sensitive film damp and placing it in the rays of the electric lamp in the opaque lantern. As the film dried, most beautiful colors were shown on the screen.

The best sensitive plates for the purpose of color photography by this method are gelatine bromide, with gelatine in excess to about thirty per cent. by weight, and an ideal plate should be perfectly isochromatic.

As M. Lippmann had been at work ten years before he hit on this happy idea of the mercurial reflector and modified plate, it proves the old adage of perseverance, and that the try, try, try again policy nearly always leads to success.

FIFTY YEARS OF PHOTOGRAPHY.

In the entire range of invention and discovery, nothing shows a more brilliant series of successes than the art of photography.

A hundred and fifty years ago, says a writer in The Scientific American, copies of writing had been made by the action of light on sensitive paper. Giambattista Porta had invented the camera obscura; and more recently Niepce and Daguerre, by different methods, had succeeded in making sun pictures; and Fox Talbot had invented the calotype or talbotype; Herschel had given to the impression made from the object the name "negative," and to the print from the negative the name "positive."

Discovery of Pyroxylin.

Fifty years ago, in 1846, Schonbein discovered gun cotton, and soon after collodion was produced by making a solution of gun cotton in alcohol and ether. It was almost immediately adopted by Archer for a film in lieu of albumen and gelatine. Pictures produced on the sensitive film having collodion as the basis superseded the calotype and daguerrotype, and were made almost exclusively after this discovery up to within fifteen or sixteen years. This film is still used by many photographers for special purposes, but more particularly in photo-engraving, and for transparencies and lantern slides. The collodion film was used for making negatives as well as positives; some of the best photographic pictures ever produced were made by means of wet-plate collodion film negatives, albumenized paper being used in making the positive prints. Prior to the use of albumenized paper sensitized with the silver salts, glass positives, called ambrotypes, were introduced by making a very thin negative image and backing the plate with asphaltum varnish or black velvet, the black background producing a positive effect. In some cases they were bleached by means of a solution of mercuric chloride. Collodion positives are still made upon thin japanned iron, commonly called tintypes.

The Dry Plate.

After a great many experiments the modern dry plate was produced,

not in its present state of perfection, but in a way which indicated its capabilities. The gelatine dry plate could not be made in perfection until after the gelatine itself had been improved so as to render it suitable for this purpose. It is to the perfection of the extremely sensitive dry plate that the great popularity of photography is to be attributed. Barring the bicycle, probably no craze was ever so widespread as that of modern photography. Methods of manipulation and improvements in lenses and apparatus have kept pace with improvements in the art itself, and the large demand for apparatus and material effected a corresponding reduction in prices. Lenses have been devised for every use, and the very recent improvements in optical glass have rendered it possible to produce lenses which are marvels of perfection.

Apparatus.

It is needless to mention the improvements in cameras and portable apparatus, for we think it would be almost a rarity to find a family of which some member is not practically interested in photography. A great impetus was given to modern photography by the invention of the hand camera, and more particularly that of the magazine hand camera. Magazine cameras in great variety have been brought out. Most of them have been fitted for the use of roll films or cut films, but a small proportion are arranged for receiving glass plates. Such cameras have been made as large as 8 x 10. The beautiful modern folding camera, being very light and portable, has become a great favorite with both professionals and amateurs. It is even more portable than the magazine camera.

From the ordinary side window as a source of illumination, the daguerrotypist turned to the skylight, and special skylights, some of them of large size, were constructed and used to great advantage in the production of pictures which have never been surpassed in soft, delicate shading.

After the invention of highly sensitive plates it was possible to make a good picture with a smaller skylight, also with a good sidelight when suitable screens were provided. With sensitive plates came the use of artificial lighting, and flash-lights for instantaneous work in the night and in caves and dark places.

Since the development of the electric light many photographic establishments have been fitted out with electric lighting apparatus, permitting of taking portraits at night and in cloudy weather. An additional advantage in the use of artificial light is that of carrying on the work on the first floor, thus saving stair climbing or travelling in the elevator. With proper management, the amateur photographer may procure flashlight pictures at home in the evening which compare favorably with daylight work.

True Color Values.

Early in the history of photography it was noticed that true color values were not rendered in any photographic pictures. Yellow, red and green always appeared darker in the picture than in the object, while blue and violet appeared lighter. To correct this defect in photographic pictures the plates were made color-sensitive by coloring them with applied dyes, or by incorporating the dyes with the emulsion used in coating the plate. The difference between pictures taken with orthochromatic plates and those taken on ordinary plates is very noticeable. Colored screens have been used in connection with ordinary rapid plates for securing similar results, and in copying paintings, tapestries and other works of art depending upon color value for effect. Both the yellow screen and the orthochromatic plates have been applied simultaneously.

Photography in Natural Colors.

Very early in the history of photography, in fact before Daguerre's discovery, the workers in this line conceived the idea of making pictures in the colors of nature, or as they are shown on the ground glass or screen of the camera obscura. Fugitive colored pictures were made which could be examined by weak light, but they were quickly destroyed when exposed to strong light. No means was ever found for fixing these colored images. Experiments looking forward to the discovery of some means of fixing and preserving the images have been carried forward without much success since the days of Daguerre.

Tricolor photography is not a strictly modern invention, but it has been perfected to a great extent within ten years, and very pleasing pictures can be produced by this process, although they do not present the ideal colored picture. Such pictures are produced by using three separate plates and taking the pictures through three separate colored screens—red, green and blue ; a positive made from a negative taken through a red screen is transparent through all places where pure red is seen in the subject represented, also more or less in parts representing purple or violet and orange. A positive taken through the green screen will be transparent in the parts that are green in the subject. It will be transparent also in the parts representing yellow. In a similar way a picture taken through a blue screen is transparent to the part representing the blue portions of the subject.

According to one method, the prints from the negative are made upon sensitized gelatine, the gelatine carrying the color which is required to build up the portion of the picture demanding that color. When these three prints are made and superposed, they reproduce approximately the colors of the scenes represented.

A modification of this method, which results in truer colors, is accomplished by making three positive black and white prints representing the three colors and projecting them on a screen, where they are superposed, suitable colored screens being placed in front of each positive. Some very beautiful effects are produced by this method.

Lippmann, of Paris, not long since discovered a very simple and interesting method of producing photographs in color. He first produces a suitable negative, prints a positive from the negative, and backs up the positive with a film of mercury. The image is seen by reflected light, and the colors are produced by interference of light in a manner similar to Newton's rings.

Photo-Mechanical Work.

Among other developments in photography within very recent years may be mentioned several methods of reproducing photographic pictures in black and white, and other tints, by lithography, photogravure, collotype, half-tone and line etching. The collotype is a simple style of photographic reproduction. In making the collotype the glass which is to support the film is finely ground, and a solution of albumen and silicate of soda and water poured over it to form a foundation for the film. Upon this foundation is poured a solution of ammonium bichromate and gelatine in water. When the plate is dry it is exposed to the light through a negative and immersed for a time in cool water, after which it is dried in a bath of glycerine and water and coated with printing ink. The plate is then printed according to the method of the lithographic printer.

In photogravure the shadows are depressed in the plate, and the printing is done on practically the same principle as that of steel or copperplate printing.

In making a photogravure, a transparency or positive is taken from a negative by any of the well-known methods, and a copper plate larger than the print to be made is cleaned and dried and then coated with a solution of gelatine and potassium bichromate in water. The plate is then dried, placed in a printing frame, and exposed through the transparency or positive, after which the surface of the film is dusted, etched and cleaned, when the plate is printed from, after inking and wiping off, either in the same manner as a copper or steel-plate engraving, or as an etching, leaving a thin film of color in different positions on the high lights to modify the effects.

In the half-tone process the sensitive plate is exposed in the camera through a grating, which leaves a texture on the negative, which, when printed through on the bichromatized metallic plate, produces lines or dots, which are etched, and which, in printing, leave high lights and carry the ink, which produces the shadows. When three plates are made through three colored screens, and three impressions are produced from the plate with appropriate colors, very good pictures approximating the tints of nature are produced. This is now the most popular method of illustrating with colors. Recently improvements in the shape of apertures in the screen have been made.

The Optical Lantern.

With the improvements in photography the projection lantern has been rendered very efficient, so that either colored or black and white pictures may now be projected upon a screen twenty-five feet square, producing very satisfactory results. In fact, some of the most popular entertainments of the day are on this order. With improvements in lenses, plates and developers, the speed of photography has been increased to such an extent as to produce a distinct image in the space of $\frac{1}{1000}$ of a second. This renders it possible to catch images of insects, birds and other animals, and even projectiles in their successive positions. By reversing the process, these images are reproduced in such rapid succession as to give the pictures all of the movements of life, without any apparent break in continuity. This is, in brief, the principle of the kinetoscope.

As an Aid to Science.

Photography has proved itself to be of incalculable value to other sciences. In surgery it has been employed for differentiating tissues. It has been employed for detecting stains invisible to the eye. It is a faithful recorder of physical phenomena, and has been made by Roentgen, in connection with the X rays, to show interior portions of the body, and make other disclosures of a startling nature.

In addition to these, photography has been used for grasping celestial objects beyond the power of the eye and the telescope, for mapping the heavens, measuring and recording spectra, showing the structure of the sun, revealing the extent of nebulæ, picturing comets, and making records of eclipses and other phenomena. It has also revealed things beyond the power of vision and the microscope.

PLATINO SOLIO PRINTS.

The Eastman Company have issued the following directions for making platino solio prints: Wash in five or six changes of water to remove the free silver.

Tone in a plain gold bath, using about 1 gr. of gold to 48 oz. of water. Neutralize by adding a saturated solution of borax, bicarbonate of soda or sal soda.

The bath should tone in six or seven minutes.

Tone by transmitted light for the

high lights and half tones only, paying no attention whatever to the shadows.

If a warm tone is desired remove prints from toning bath as soon as high lights are cleared.

We recommend a neutral bath, and advise the use of Squibb's red litmus to test with.

If the bath tones uneven or streaky, add water until it tones in eight or ten minutes, and make it slightly alkaline.

When toned immerse prints in running water, where they remain until all are ready for the fixing.

If running water cannot be had, put prints into

Salt	1 oz.
Water	1 gal.

If there is a large batch of prints to be toned do not allow prints to lie in short stop solution, but put them into a tray containing clear water, where they may remain until all are ready for the fixing.

Hyposulphite of soda...	12 oz.
Water.....	1 gal.
Solio hardener.....	¼ oz.

The regular solio fixing bath may be used in place of above fixing if desired.

Fix twenty minutes, keeping prints in constant motion the entire time they are in the solution. Allow one gallon of fixing solution for each gross cabinet prints or their equivalent.

Wash one hour in running cold water or in sixteen changes of cold water, keeping prints separated so that the water may have a chance to eliminate the chemicals.

Prints allowed to stand over night in water are liable to turn yellow. They should be mounted as soon as washed.

After burnishing, grind the face of print with fine ground pumice stone, rubbing with the hand all over the surface until the gloss is removed. Brush off the print with a camel's-hair brush or a tuft of absorbent cotton. It takes about a minute to do the work on a cabinet print, and the results obtained are richer and more brilliant than can be produced on matt surface paper.

A FEW GOOD HINTS.

(From Hammer's Little Book.)

A soft camel's-hair brush may be used to remove the dust from plates before placing them in the holder or dark slide. If the brushing is done hurriedly, the film will be instantly electrified and attract to itself more dust than you remove.

When plates are exposed and set away for future development, be sure to set them face to face, as they were in the original boxes. If the face or film is placed against the back, you will probably have finger marks on the film, caused by the fingers coming in contact with the backs of the plates while placing them in the holder.

It is advisable to use a fresh solution of hyposulphite of sodium each day during the hot weather. The fresh solution hardens the film, and alum will not be necessary.

Thorough fixing and thorough washing, followed by quick drying, will insure permanency and fine printing quality in the negative.

To prevent sand or rust from striking the negatives while washing, tie a piece of cotton flannel over the faucet.

Negatives exposed to white light before the bromide of silver is thoroughly dissolved in the fixing solution will be foggy, and the printing quality will be injured.

A solution of bromide of potassium (one ounce of bromide to ten ounces of water) should be in every developing room. When plates are a little over exposed, a few drops of this solution added to the developer will restrain its action, and may thus produce a good negative from what would otherwise be a worthless plate.

Keep your lens clean. Dust on the lens is often the cause of foggy plates. Brighter and clearer work can be made with a clean lens than with an unclean one, whether it produces fog or not.

William Francis Magie, Ph. D., Professor of Physics at Princeton, uses Hammer extra fast plates in making pictures or shadowgraphs by the Roentgen method, or X rays.

A large proportion of the silver may be saved from the fixing solutions and print washings, and gold from the spent toning baths, in the following manner: To the print washings add common salt or hydrochloric acid; the silver will be thrown down as chloride. To the fixing solutions add sulphide of potassium; the silver will be thrown down as sulphide. In the toning baths add a solution of sulphate of iron, which will precipitate the gold. Collect the precipitates on a cotton cloth, dry, and send to a refiner. Keep the gold and silver residue separate.

Local reduction can be easily accomplished by means of powdered sepir and a piece of soft leather, rubbing gently until the object is attained.

Metol poisoning may be avoided by the exercise of the greatest cleanliness in using this developer, washing the hands frequently. Hauff advises to "rub the hands well with vaseline and dry them before beginning to develop, and then after finishing wash them immediately."

Halation is avoided by the use of the Hammer non-halation plates, with which sure results are attainable. All methods of patching up the back or "doctoring" a single-coated plate are impracticable.

For line engraving and process work use slow plates with double the quantity of pyrogallic acid and sufficient bromide of potassium to hold the lines absolutely clear. Distinct, sharp lines are best obtained by using small diaphragms in the lens.

Better work means better business. It may come a little slowly, but stick to it. Make the best you know how, and you are sure to win.

Use the Hammer aurora non-halation plate for microscopic work, and you will get finer results than can be obtained on any single-coated plate.

Don't reject other people's ideas without consideration.

Better take a hint, and not make a kick necessary.

The secret of success is constancy to purpose.—Disraeli.

Keep your skylight clean and note how much more rapid your plates are, especially in dark weather.

There has been a false impression as to the part which sulphite of sodium plays in the pyro developer. It is a stain preventive, and all right in its place; but it is not a pyro preservative, and should not be in the stock solution.

Pyro made up with just a trace of acid and no sulphite will keep clear for a long time (see first pyro formula in this book); but if there is sulphite present it soon deteriorates.

Sulphite of sodium should be made up in a separate solution, or with the carbonate of sodium (or carbonate

of potassium), because it is only during development that the benefit is derived from the presence of sulphite —that of controlling the amount of color (or stain) that shall be present in the finished negative.

HINTS ON ENLARGING FOR BEGINNERS.*

There has been a discussion lately taking place which affects one side of this subject. It was on the respective merits of (1) Large pictures made by enlargement from small negatives; (2) Large pictures taken direct.

A lot of well-known photographers spoke for both. I may say that before reading any of these arguments, I had made up my mind which I favored, viz., enlarging from small negatives, there being some very strong arguments for it as against the other. The first is a saving of weight when in the field; secondly, by varying the exposure of the enlargement, the contrasts may be increased or decreased at will; thirdly, any microscopic details may be suppressed. But for subjects where very minute details are required, such as architecture, there is the disadvantage that when the picture is enlarged, the details of it are enlarged also, and consequently it will not bear the close examination of the direct photograph.

This leads on to another discussion as to which ought to be favored—diffusion of focus, one plan being practically sharp, or suppression of focus throughout the entire picture. This, of course, is not the time to argue the respective merits of the two, but I will say, in passing, that whichever is favored there can be no doubt that, excepting in the case of architectural objects, he is no artist who aims at getting microscopic details all over the picture.

The first thing to be decided is the negative to be enlarged, and the size to which to enlarge it. I enlarge nearly all mine to 12½ x 10½. This allows half an inch margin for trimming.

Suppose we are going to enlarge from quarter-plate to 12½ x 10½. The negative is placed in the carrier between the lens and the condenser, upside down, and glass towards condenser. Care should be taken to observe this last, as, in a hurry, one easily forgets, and, of course, the result is a reversed image, which is sometimes an advantage. But we are supposing a print is required the same way as in nature. Well, the negative is in the lantern, and the lamp centred till light is equalized all over the disk. The distance must be found at which the screen is to be put to get the image of the size required. The rule to find this out is: Add one to the number of times of enlargement required, and multiply by the equivalent focus of the lens. The answer will be the distance between the lens and the screen. Thus, if enlarging with a lens of 6-inch focus a quarter-plate to 12 x 10, the sum should be like this, $3 + 1 \times 6 = 24$ inches from lens to screen. To find the distance of lens to negative divide the focus of the lens by the number of times of the enlargement, and add the result to the equivalent focus. The sum would be like this for quarter-plate to 12 x 10 with 6-inch focus lens, $6 \div 3 + 6 = 8$ inches. Therefore the lens would have to be placed 8 inches from the negative and 24 inches from the screen to enlarge a quarter-plate to 12 x 10 with lens of 6-inch focus. If the focus of lens is not known, all that has to be done to find it out is to focus some object about a hundred yards away with the lens in an ordinary camera, the distance being measured from the ground

* A Paper read before the Herefordshire Photographic Society by Mr. Wilfrid Groom.

glass to the diaphragm slot if a double lens, and to the lens itself if a single one.

We have now got all ready for focussing the image on the screen. To do this it is absolutely necessary to get the screen parallel both ways with the negative, or uneven definition will result, and to get the lens opposite the centre of the screen. A good way to find this out is to get a piece of string and hold one end in the centre of the lens, while with the other end you measure to each corner of picture and shift about the screen or lantern till all are equal.

Now comes the crucial point—the exposure.

It is better to decide on one size, and work out exposures from it. I always think to myself—"Now this negative will take so long to enlarge to 12 x 10, therefore it will take so long to enlarge to 24 x 18," or whatever size decided upon.

No hard and fast rule can be laid down for exposures, as the quality of negatives differs so enormously. Of course it is a great advantage in enlarging particularly to have negatives of regular density, but it is no good my telling you that, as you all develop your negatives by Mr. Watkin's method, and consequently get negatives perfect in every way. But should there by any chance be anyone who is so behind the times as not to use it, and who does get different quality negatives, I will say that, besides density, a great point is the color of a negative. A dirty red negative will take two or three times as long as one of the same density, but of a clear color.

Supposing it is known that five minutes are required for a certain negative to enlarge from quarter-plate to 12 x 10, and we want to enlarge the same negative as one of equal quality to 24 x 18, or double its diameter. It will not take double the exposure because there is double the length of the picture, but will require four times the exposure because the area is quadrupled.

The rule for finding increase or decrease of exposure, as given in Mr. Dresser's book on "Enlarging," is apt to mislead one unless worked with the first factor as one. This is not always convenient. He says: "As the original distance is to the increased or decreased distance squared, so is the original exposure to the length of time which it is desired to ascertain."

Let us work one out, then. Let the original distance be twelve inches. We will increase it to twenty-four inches, and let the original time be five minutes,

$$\text{as } 12 : 24^2 :: 5\text{ m} : x$$
$$x = \frac{24^2 \times 5}{12} = 240\text{ m}$$

or just twelve times as much as the proper answer. If worked out with the first factor as one foot instead of twelve inches, it is

$$1 : 2^2 :: 5 : v\,x \frac{2^2 \times 5}{1} = 20$$

which is right. A way to work it out in which you cannot get wrong is this: Find the number of times the equivalent focus is contained in the two distances from lens to paper, then square the numbers, and there is the ratio of exposures. Thus, if we still work out the sum with distances twelve and twenty-four inches with 6-inch lens, the sum stands as

$$(12 \div 6)^2 : (24 \div 6)^2 :: 5 : x$$
$$\text{as} \quad 4 : 16 :: 5 : x$$
$$x = \frac{16 \times 5}{4} = 20\text{ m}$$

The exposure is decided on, ruby cap placed in front of lens, paper pinned up, exposure given and noted down, and, unless clouds are to be printed, it is ready for development.

But, supposing it is a landscape which requires clouds like the large one of the Lugg, the landscape part of the picture will have to be exposed first, and if it has a thin sky, it must either be blocked out in the negative or marked off. The red cap must be replaced and a mask put over the exposed part, only leaving a little part of landscape above the mask. Then the negative must be removed and the cloud negative inserted instead of it, the cap taken off, and exposure made while a piece of brown paper or anything is kept moving just above the fixed mask, so as to prevent a hard line being formed. It is then taken off and developed in the ordinary way.

If it is a portrait which requires vignetting: the vignette can be made of cardboard by simply cutting a hole out of the centre and moving it to and from the print (not sideways) throughout the whole of the exposure. Of course, if a vignette glass which fits the negative is used, it can be fixed in front of the negative and exposure made in the ordinary way.

Another way to print clouds in is to expose the landscape, partly develop it, and then add clouds by pinning the print up again and exposing. The only advantage this has is that you can see where to mask all the time; but still, if the other mask before described is cut well, one does not require to see the landscape. A disadvantage in the latter method is that one is liable to tear the print when pinning it up again, or make it dirty.

Now to develop it:

There are two developers which I have used—ferrous-oxalate and metol. Each has some advantages over the other. I very rarely use anything but metol, as by using it the clearing bath is done away with. Also, if the correct exposure is given, the print will not over-develop. I would advise everybody to use it under ordinary circumstances; but in a case where by altering the exposure you want to get more contrasts, I would suggest the ferrous-oxalate. With this the color of the print may be anything from velvet-black to slate, according to exposure. Under-exposure gives a black print and more contrasts; over-exposure flattens the image and gives a slate color. All the tints got with ferrous-oxalate are obtainable with metol, excepting black. The reason is, if the print is under-exposed, it will not develop at all, or, rather, it will not develop sufficiently.

The color one requires is, I think, one half-way between the two extremes, just too black to prevent its being flat, and this is the color obtained by a normal exposure and developed with metol.

The image on bromide paper does not require developing beyond what the finished print should be, as, although it goes off slightly in the fixing bath, it regains all it loses when dry.

When developed, the print should be washed in running water for about five minutes, then put into a 20 per cent. bath of hypo, and left there for about fifteen minutes. It is better to keep all solutions, including hypo, constantly moving to secure equal development all over the print, and even fixation.

After fixation the print should be washed in running water for two hours.

Reverting to the merits of metol as against an iron developer, the former has all the advantages of the latter except one (and that is a doubtful one) and more besides. Unless a series of three or four cleaning baths are used immediately after development with iron, one is liable to get yellow prints, due to a deposit of iron on the print and the sulphuration of it in the hypo bath. One can, however, tell if the iron is removed by noticing if any

unpleasant smell is thrown off when the print is put into the fixing bath.

In the event of over-development, the print may be reduced with an ordinary iron reducer.

A good way, I understand, to wash the prints quickly is to squeegee them on to glass. This presses out all the surplus liquid. Then strip off and leave in water for five minutes. Repeat until it has been done ten times, which means just half the time the other way would take. I have never tried this process, but have it stated as a good one on very good authority.

Local development is very useful for bringing out any part of the picture which may need it, such as cloud effects in the landscape negative, or roofs of houses taken on a very bright day. It is done either with a soft sponge or a soft brush. The dish is tipped up till all the solution is off the print. It is then applied to the part to be affected. It will be found best to develop the print as far as it is intended, wash it, then do any local development. By doing this it prevents the remainder of the print continuing to develop.

Lastly, we come to the trimming and mounting. This I do when the print is wet, as I find it flattens out so much more easily. Either starch or gelatine may be used, and need not be applied too thickly. If gelatine is used, care must be taken to apply it quickly, or it will harden before it is put in the mount. The print may be pressed flat by using a soft sponge.

The finished picture is then ready for drying. It is a good dodge to get two hooks—to be found in any lady's work-basket—and connect them with a piece of string slightly shorter than the mount. One hook is slipped over each end of the mount, and it is left to dry in a bent position. Of course, the string must be put at the back of the mount to counteract the tendency of the print to curl.—Photography.

COLOR TONES, AND SOME METHODS OF AFTER TREATMENT OF BROMIDE PRINTS.*

The final color of a bromide print depends largely upon the following factors, namely: (a) Actinic strength of the light; (b) length of exposure; (c) transparency of the negative; (d) strength of developer; and (e) duration of development.

By judicious variation of the relative proportions of each of these factors, to suit the particular quality of negative, it is possible to obtain fairly uniform results; that is, the work of exposure and of development can be substituted for each other within certain limits.

It is possible, by over-exposing much, and by strongly restraining the developing action by the use of a large excess of bromide, to bring up the details in the picture before reduction passes to the grey or black stage, and so to complete the picture in a sepia tint. Again, by long exposure in a strong light, with a thin negative, weak developer and comparatively long development, it is possible to get the middle stage (grey) tones uniformly over the whole picture. By employing relatively low actinic light and fairly short exposure, you can get, with similar negatives and medium strength developers, uniform black tones of the final action.

The black tones are usually preferred, and so for general work I use weak light (a candle with half inch wick) and medium developer, and I hardly ever miss the desired result.

To return to my subject, it is possible to choose beforehand your color in which the bromide print is to be finished. By proper treatment, of course, the pure black tones which are so much admired can be obtained; if

*A communication by J. L. Van Geyzel, to the Photo. Society of Madras.

not there are other methods available by which the color can be changed to pure black. I mean by TONING. It must be remembered, however, that gelatine pictures tone with greater difficulty than albumen ones, and consequently there is a tendency to strong after-toning action in the case of the former. They must, therefore, be removed from the bath before the desired color is got. The usual precautions, namely, free acid washed out of the print, neutral or faintly alkaline toning bath, sufficient gold, and absence of organic matter and dust which precipitate the gold, must be adopted. Any of the usual toning baths may be used before fixing, or toning and fixing baths may be combined, or toning may be done after fixing. The latter is the most difficult, as the high lights, which tone before the deepest shadows become blue, are lost. These processes are somewhat troublesome. I have tried them, but I cannot say that I have succeeded in obtaining satisfactory results. When the developer is too much restrained, often a green-black color results. These tones are not considered pleasing, and may be changed to a pure black by toning with gold (the usual sodium acetate and gold being a good bath) or with platinum, In toning with platinum chloride, the print should be very vigorous to start with, as this toning bath weakens the picture. The color may be changed to warm tones (sepia or brown, etc.) by toning with uranium salts.

The print must be thoroughly free from iron and from hypo. It is immersed in potassium ferricyanide, 9 grains; uranium nitrate, 8 grains; glacial acetic acid, 5 drachms; water, 16 ounces.

This solution will tone through dark brown to red shades. When the desired color is reached, wash the print only till the yellow color of the whites disappears, and dry it.

I have hitherto mentioned only the color tones of bromide prints in so far as it is possible to choose, and to obtain whatever tones are desired by development or by subsequent toning, but the ordinary worker will sometimes get tones which are anything but pleasing, from greenish to a dirty yellow color. Photographers generally will understand the kind of prints referred to, when I say that my remarks apply to prints which are thrown away without any hesitation whatever because of their "bad color"—flat, dirty, yellowish, or greenish looking prints, with no whites about them at all. The professional worker can, under these circumstances, recoup himself, but to the amateur it means serious loss to throw away large sheets of bromide paper. I was led to attempt the redemption of such prints from sheer necessity. I began making some enlargements for our open exhibition (which was then approaching) during the last N. E. monsoon season, and I was simply washed out of the dark-room. It leaked, it got mouldy, and, when at last a sunny day arrived, to be locked inside my damp dark-room for half an hour was a thing not easily to be forgotten. Sheet after sheet of bromide paper came out spoilt, there was precipitation of iron in the paper, the whites were dulled, the general color was sickly, and altogether there was nothing to do but to throw away this packet of bromide paper. I tried reducing one of these prints in the hope of clearing some of the whites, and, to my delight I saw the ferricyanide solution turning bluish, and the whites of the paper clearing. Fresh reducing solution was used, and the operation continued to see how far matters would go. This print became over-reduced, and fine details and half tones were lost; the next print was similarly treated, but more carefully, and local reduction, when necessary, was done by means of cotton wool

A REFLECTED BEAUTY.

soaked in the reducer. The result was certainly an improvement, but there was lacking the richness of color and contrast which give brilliancy and depth to a bromide picture. I happened then to be toning stereoscopic transparencies (at Mr. Dunsterville's suggestion) by intensification with mercuric chloride and rodinal. I show you here one of these stereos so that you may judge of the beauty of the color produced by this method in a transparency. The reduced bromide print was now bleached in a solution of mercuric chloride, well washed, and redeveloped with rodinal. The result was a picture with that bluey neutral tint which bromide workers envy. To see whether this was accidental, I tried another bilious print with this treatment with similar results, and since then I have done many small prints also in the same way, when I have wished to change their color. These tints I have never succeeded in obtaining by direct development of exposed paper by rodinal, amidol, metol, hydroquinone, or the ordinary ferrous oxalate developer; and there is no other method that I know of for obtaining these tones with uniform success. For REDUCTION I use the reducing solution known as Farmer's reducer, namely, one in ten hypo solution, with a few crystals of red prussiate of potash, enough to make a solution of pale sherry color. This does not keep, so it must be made up fresh; the more ferricyanide is used, the stronger is the reducing action. Care is necessary during this process, for there is a risk of losing the half-tones, which are more quickly attacked than the deep shadows. It is therefore safer to work with a weak reducing solution, and to reduce locally with a plug of cotton wool soaked in it, and to finish off by flooding the print, otherwise the reduction is apt to be patchy. The process is one which I employ not only for enlargements, but for small prints also; a short dip in the reducer, immediately after the fixing bath, clears the whites and adds brilliancy to the print. There is, however, a tendency for the whites to get colored faintly yellow; but this is entirely obviated by putting the print through a plain hypo bath for a minute or two after it comes out of the reducer and before washing with water.

BLEACHING is done by placing the print in mercuric chloride (corrosive sublimate) solution. I employ a solution of five grains to the ounce, and bleach till the heavy shadows are just acted on, for the process continues during the subsequent operation of washing. Too strong a bleaching solution is apt to clog the heavy shadows. After washing, which need not be prolonged,

REDEVELOPMENT may be done by pyrogallol, by weak ammonia solution, by sodium sulphite, by ferrous oxalate. I have tried all these; but better than them all is a one-in-thirty (or even one-in-fifty) solution of rodinal. The point to be careful about here is not to overdo the redevelopment; rodinal is very quick acting, and the picture returns in no time; when the bluey tone is coming on (which can be judged by daylight better than by lamp-light as at present), pour off the developer and wash it off the print at once with water. If the print is slightly overdone, pass it through the reducing solution again till you get what you want. I have only to add that washing must be thoroughly done between each operation, otherwise bleaching and redevelopment will each be patchy.

There is hardly a bromide enlargement which is made, but that it requires FINISHING more or less.

An enlargement with obvious defects, which can be easily removed by pencil or color, but allowed to remain, is a terrible eyesore to the critic

who is accustomed to see finished prints. Why should the trained eye be offended in this way?

There is not an enlargement made, but that it will require respotting. If it does not want it when dried after fixing, it will want it very soon before it is glazed and framed, for the poochies will soon eat out spots in the deep shadows. A fine camel's-hair brush is dipped in very dilute Indian ink or neutral tint of the proper depth, and the white spots are filled in by dots of the color put on carefully with the point of the brush.

Again, in enlarged pictures, gradations of light and shade should, if required, be corrected with color and pencil. I do not advocate extensive filling in as a rule with color and pencil what ought to be done photographically; but there are instances when to save a picture it is quite legitimate to resort to the brush.

I ought to mention that before beginning to touch an enlargement, especially a face, all the effects of lighting should be carefully studied in an ordinary proof printed from the original negative. When the broad effects, so to speak, have been noted, the details of the finer shadows and lights—their extent, depth, gradation, etc.—are observed through a hand magnifying glass as the process of retouching goes on.

I strongly deprecate the use of color and pencil to fill into a photograph what should be there by legitimate means; and certainly in the case of small pictures, anything beyond respotting should condemn it as a photograph. But in the case of enlargements, it is necessary to soften harshnesses which are inherent to the process and to the mere fact of enlarging; at the same time it is necessary to carefully avoid over-retouching them, and so destroying that breadth of effect which is secured by the enlarging process.

A VISIT TO THE OPTICAL WORKS OF C. P. GOERZ, AT SCHONEBERG, NEAR BERLIN.*

Mr. Goerz, the founder of the optical works which bear his name, is a man in the prime of life, peculiarly gifted with a talent for organization and full of friendly interest for his employees.

From an origin in a small way, began in 1889 with one optician, he has built up, in seven years, a business sending its products over the entire world. And to-day these works are the largest in the world, exclusively occupied in the manufacture of photographic objectives. He began originally with the lynkeioscope calculated by Moser (now deceased), and this formed a good foundation, as his good fortune brought him into contact with the genial mathematician, Mr. von Hoegh, who calculated the double-anastigmats for him, using the new Jena glass. With this instrument a period of undreamed of prosperity began. In four years the double-anastigmats conquered the world. A branch was established in New York, and the patent license for England given to the renowned firm of Ross & Co., London. Further on in the line of development it became necessary to establish branches and various workshops outside of the optical works, as, for example, for the manufacture of iris diaphragms. The works now employ a force of about 250 men. Outside of this, about forty opticians are kept busy. Originally in rather small quarters, the opticai works are now established in a large square building, where the manufacture is carried on in six departments. And already wings to this building are beginning to go up.

*Translated for this Journal from the German of J. Gaedicke.

The blocks of optical glass go through the first process in the basement of the building. Here they are cut into plates of carefully determined thickness by vertically rotating zinc plates, whose lower edges run in petroleum, the cutting edge being provided with diamonds. After they are cut down to squares of a particular size, these squares are cut off into an approximately circular shape [by (pliers) used for that purpose]. Then follows the grinding with sand on rotating brass forms or gauges, which have a special curvature for each lens. The lens has now reached its "raw" form, yet it is only a single tenth of a millimeter thicker than it must be in its finished condition. The lens now goes into the third department. Here we see a large number of lathes, such as are used for grinding, one crowding the other, at each a workman. Here the lenses receive their final grinding and polishing by means of emery, becoming gradually finer and finer, and rouge. Of the accuracy required in the final grinding no ordinary mortal can form any idea. There are no mechanical measuring instruments of precision for this purpose, and recourse must be had to a physical phenomenon, namely, the wave-length of light, which as known is within the one-hundred-thousandth part of a millimeter. It is the "Newtonian" color-rings which are used to distinguish the correctness of the final grinding. Next we find used for every curvature an exceedingly accurate glass gauge, i.e., a glass form, which a properly ground lens must very accurately fill. The lenses in process of work are cemented to a wooden handle, and are ground on a rotating brass form.

From time to time they are fitted to the gauges, and observed from behind; if there is a departure at any point from the form of the gauge, Newtonian color-rings form at this point. The grinder notices this place, and makes the proper correction by soft pressure during further grinding. Herein lies the greatest difficulty in making a good objective; because a certain power of observation and knack in the grinder are required, and these are inborn, and cannot be found in every one. The strength of the Goerz optical works lies in its selection of workmen having these characteristics, and it is a pleasure in going through the works to observe the intelligent faces of these men. When the lens has been properly ground, it no longer shows color-rings when put in the gauge, only a colored tone, which changes on a somewhat stronger pressure. To reach this point requires much time and patience. There are now in each double-anastigmat twelve such lens surfaces to grind, each having a different curvature. It is not, however, to be supposed that these curvatures, once calculated, always remain the same. They are the same only for one casting of glass of about 100 kilo, here used up in five to six weeks, and three castings, differing in their optical characteristics, are required for each lens. As soon as a new casting, whose retractive index does not correspond with the previous one, is taken in hand, the curvature must be calculated according to the new condition, and the glass gauges corrected. Consequently the calculation never ceases, and in the "calculation-room" two assistants are continually occupied with these calculations under the direction of Herr von Hoegh. Small lenses up to forty m.m. diameter are ground by hand, while larger ones are ground on automatic lathes with power and automatic action. Before polishing, a lens whose grinding is completed looks black like velvet. The lenses now go to the department situated on the top story, where they are centered, i.e., the optical axis is brought into the middle of the glass. In the case of small

lenses this is done on a lathe, in which it is so placed that the image of a window mirrored in the lens must not move on its being rotated, in the case of larger lenses by means of a very fine indicating lever, which must not change its position on the rotation of the lens. The six lenses belonging to one double-anastigmat are cemented together with Canada balsam in another room, so as to form two symmetrical combinations. Their being cemented together in the correct order is secured by means of an indicating lever connected with a delicate scale.

Now the glasses leave the hands of the opticians and go to the mechanics for mounting. Two departments are composed of the mechanics.

The mounts received in the form of castings are turned down to the proper form on lathes. All advantages for manufacture in quantity are here; for example, turret lathes are used, having six turning tools mounted on a rotating turret, so that six different tools can be used without adjusting a new one. A seventh cuts the thread. The two mechanical departments are as completely filled up with lathes as are the optical departments with grinding lathes.

When the lenses have been properly mounted they come to the testing room, where each lens is subjected to a searching examination. A very ingenious apparatus, making it possible to test many lenses in a short time, is erected for this purpose in a dark room. The testing official of the works, who certainly holds a very responsible position, need not move from his position while at work, and from it can direct any alteration. He screws the lens into position and closes a circuit by which an incandescent lamp is lit, thus illuminating a very exactly engraved screen with a faint background. On being focused, the objective throws an image of the screen on a ground glass. The screen must be sharp to the corners. Now the screen is moved to a certain angle to one side, and the ground glass to the opposite side, and the lens rotated on its axis. When this is done the image must remain motionless and show no falling off in quality. If the lens does not stand these tests it is sent back for correction of its centering; if it shows itself faultless it goes to the engraver to be provided with firm name and number, and then is placed in stock.

On the ground floor sits the head of the works, and from this centre comes the impulse moving every part, and representatives go out to every part of the world "Segen its der Muhe Preis." The Goerz works have significant results to show; for on December 2, 1894, they celebrated the completion of 20,000 objectives, and now the numbers have already passed 29,000.

Complaint of the high price of the well appreciated Goerz lens is often made in the commercial world. This would certainly be justified if only the value of the glass and brass were considered. Any one, however, who has followed our description can form an idea of the amount of knowledge and labor necessary for the production of one lens; and whoever further considers that six such lenses, many of which must be thrown away, belong to one double-anastigmat, will no longer consider the high price remarkable. The value lies also in the completed form on which its efficiency depends. The best proof of the reasonableness of the price of the double-anastigmats lies in the remarkable sale they have attained in a short time; could the same effects be obtained with cheaper lenses these would certainly have had the larger sale. In conclusion, we wish continued prosperity to the optical works of Mr. C. P. Goerz, on the path so successfully entered upon, to the credit of German industry.

A CHEAP AND EASY PRINTING PROCESS.

In winter and dull days, and especially in the case of residents in the vicinity of large towns, where the atmosphere is heavily charged with vapors, and rendered thereby yellow and non-actinic, the ordinary methods of silver printing are rendered extremely slow and tedious, whilst such processes as kallitype, the ferro-prussiate and platinotype, are out of the question except for those wealthy devotees of the "black art" who can afford the luxury of an arc lamp, or the new magnesium-oxygen apparatus. Of course, there is bromide paper always with us, but it is expensive, and requires great care in handling and very correct judgment in exposure and development to secure good results. Moreover it needs a special class of negative, and we are limited to black, if we do not care to go to the trouble of either uranium toning, chlorising and redevelopment, or the Japanese method of bleaching in lead ferricyanide, and subsequent treatment in salts of copper, iron, nickel, etc.

The following remarks are intended to draw attention to the facility with which a very pleasing printing paper, cheap, easy to work, rapid, and giving wide range of tones, may be prepared. For the smaller sizes (quarter and cabinet), any good well-glazed note-paper may be used. Having placed your paper on a sheet of millboard, covered with a clean newspaper, proceed to brush on with a pellet of wadding the following solution. Dissolve in four ounces of boiling water one ounce of gelatine or good pale glue, previously soaked in cold water, when thoroughly melted add one and a-half drachms of common salt, and shake well. Now pour in two ounces citric acid dissolved in three ounces of hot water, to which has been added slowly one ounce of clean crystals of washing soda, and stirred gently till effervescence has ceased. Shake all well till thoroughly mixed, then add, a drachm at a time, shaking between each addition, one ounce of silver nitrate, dissolved in one ounce of hot water. Make up bulk to ten fluid ounces, and after well shaking, allow to stand for three or four minutes, when it is ready for use. The emulsion is best made by gaslight, and kept in a yellow bottle or wrapped in orange paper; it should never be exposed to white light. The paper should be liberally coated by brushing from right to left and top to bottom of the paper to obliterate any streaky marks, and immediately dried before a clear brisk fire. It should be kept either between the leaves of a blotting-book, or in bags of brown paper, to exclude light and air, as is done in the case of the commercial papers. The emulsion itself appears to keep indefinitely, and the paper, if kept dry and from the air, also keeps well.

The best negatives for use with this paper are those free from fog, and with clear shadows and fair degree of density; if deficient in these respects, they may be greatly improved by soaking in hypo, reducing till cleared of fog in weak ferricyanide of potass. and hypo, thoroughly washing, and then intensifying by mercury followed by hydroquinone, pyro-soda, or ferrous oxalate.

The paper may be exposed in the usual way, till either fully printed out, or the printing may be arrested at any stage and finished by development. If this is done, remove the print into gaslight, or behind a yellow screen, and immerse it directly into a developer made thus: Solution A—Eikonogen 60 grains, quinol 60 grains, sodium sulphite 2 ounces, potass. bromide ½ ounce, citric acid 1 drachm, salt 2 ounces, water 20 ounces. Solution B—Washing soda 2 ounces, water 20 ounces. Place the print in

solution A, using just enough to cover print. In about a minute pour off the developer into a glass, and add about 50 per cent. of solution B. Develop till full detail appears, but do not go on to too great density. The print at this stage will be of a bright yellow; if it has had full exposure, and if now fixed in a twenty per cent. solution of hypo and washed and dried, which may be done before a fire, the color will be red or red-brown. A shorter exposure given would result in a good sepia without toning. Very short exposures require more alkali, and give a green color very suitable for landscapes, woody glens, etc. For this purpose, however, a strong amidol developer, restrained, works better. If the developer is found to give too much density, add more water, and if very warm tones are desired, more potassium and bromide. With ammonium bromide and ammonium carbonate, a very curious effect results. The surface of the print appears fogged and dull, but on holding the picture up to a light a beautiful crimson transparency is seen, especially if it be waxed or treated with vaseline after drying.

The prints also tone well and rapidly in either the acetate, phosphate, soda carbonate, or sulphocyanide gold baths, or in the combined bath, fixing afterwards in every case in a twenty per cent. hypo bath. Prints that have been fixed without toning may, after well washing, be afterwards toned to brown or to Bartolozzi red in the uranium bath, made of uranium nitrate 10 grains, potass. ferricyanide 10 grains, acetic acid 1 drachm. water 10 ounces. They may also be bleached out in mercury bichloride, washed, and passed through the hypo bath. This is suitable to very dense prints, and gives a sepia, which may be modified, if desired, in the sulphocyanide bath. Another method of toning, giving beautiful rosy purple tones for children's portraits, etc., is to print out moderately deep, wash the print, not exposing to light, and immerse in just sufficient to cover of a bath made of gold chloride 1 grain, potass. bromide 10 grains, water 2 ounces. This makes a deep red solution; let the print remain in about five minutes; it will bleach slightly. Rinse and pour on a small quantity of developing solution A diluted. When sufficient density is gained immediately pour off and cover the print with hypo to stop further action.

By selecting stout paper or even thin cardboard larger than the prints wanted, say 9 x 7 for a 5 x 4 print, and coating the centre portion through a mask cut out of stout brown paper, and also by printing through a mask, the troublesome operation of mounting may be entirely dispensed with.

Finally, should the emulsion at any time become fogged or spoiled from any accidental cause, the silver can be easily recovered thus: Add to the emulsion ten or fifteen per cent. of hydrochloric acid, immerse the bottle in a saucepan of cold water, and slowly raise the whole to boiling point, for about half an hour. On cooling, the whole of the silver will be found at the bottom as a white precipitate. Pour off the top fluid, and add to the remainder, slowly, some hot saturated solution of common washing-soda. Now pour off the contents with all the white precipitate into a dish, adding some old quinol or other developer, and exposing it to light. The white precipitate will speedily darken, and finally become quite black. The next day the supernatant fluid may be carefully poured away, taking care not to lose any of the black powder. Fresh water should be added, and the whole transferred to a tall bottle and allowed to settle once more. Pour off the water as close as possible, and add carefully, a little at a time, strong nitric acid,

shaking round till dissolved (heat assists the process). The resulting silver nitrate may be poured into a clean porcelain dish, and put into a warm place, free from dust, to crystallize out, and once more utilized for fresh emulsion making, the free acid being first neutralized with a little soda carbonate. By varying the proportion of salt in the emulsion, hard or soft negatives may be printed from, but the proportion given is, perhaps, most generally useful.—Photography.

DARK-ROOM MANIPULATIONS.

BY W. E. A. DRINKWATER.

Tackling Unknown Exposures.

Now to tackle a batch of plates of all sorts and conditions of exposure —and those unknown. As we shall have to feel our way and develop slowly, it will be advisable to turn the light down a bit in our dark-room lamp, or else put another sheet of orange paper in front of it. Three lots of developer should be made up. Pyro 1 part, metol 1 part, and soda 2 parts, should be mixed and diluted with an equal bulk of water. On the right hand of this place another measure, containing pyro 2 parts, metol 1 part, and soda 1 part, with the addition of bromide 50 minims per ounce of developer. On the left, still another, containing metol 1 part, soda 2 parts, and no pyro. We start development with the diluted mixture, and note its action. The image will be longer making its first appearance than would be the case with a full-strength developer. So much the better, because we can notice whether the shadow details are hanging back or rushing up at the same time as the high lights. If all gradations appear in their due order, development may be comfortably finished in this same solution, only remembering that slow development will tend to increase color, and washing must be regulated accordingly. Suppose only the highest lights show after a reasonable time—say, one minute—pour the developer back into its own measure and flood the plate with the fast developer on the left—metol and soda. Even now it wants watching closely, and if it acquires a tendency to flatness under the fresh treatment, exchange back again to original developer. If the first appearance of the high lights is quickly followed by the half tones, immediately pour off the developer and substitute the contents of the right-hand measure. "Smart" is the word where there are such signs of over-exposure. In any case, where the first appearance has that grey, flat look we all know and dread, every effort should be made to get the restrained developer to work before the shadows have made a start towards developing. Should a plate be unlucky enough to have clouded over before we could get the restrainer into action, we have only one course open to us, i.e., keep on developing long after the plate has gone black all over, and until it appears quite opaque when held up to the ruby light. The worse the over-exposure, more need for prolonged development. We can always reduce a negative to printing density; but it is very difficult to intensify with any confidence.

Fixing.

Our fixing bath is conveniently made with equal parts of saturated solution of hypo and water, measuring each with the dipper belonging to the hypo jar. It is a great mistake to make the fixing too strong. It is quite possible to make a solution of hypo so strong that it will entirely refuse to fix a plate. The solution in such a case is so dense that it has not the power of permeating the gelatine, and therefore cannot get at the bromide of silver locked up in the film. Fixing is a job that many photog-

raphers treat in a very slipshod manner. Flat dishes are generally used, and of all things they are the most unsuitable. The ideal method would be to fix a plate film downwards, but that is hardly practicable. The next best way is to put them into hypo in a vertical position, or nearly so. I have for some years used the old glass baths and dippers, but they are rather costly when each bath will only hold one plate. There is, however, now on the market (Tylar) a very effective and cheap fixing bath of the vertical form, made of papier mache, and holding six plates at a time on six séparate dippers. Into this our first plate can go when it is washed sufficiently, and should not be disturbed until we have filled all the other dippers in rotation. Above all things we should avoid constant removal from the bath to see how it is fixing out. During the early stages of fixation there is a greasiness on the film due to the imperfect mixture of the water contained in the film with the hypo solution. If the plate be brought out of the bath before this greasiness has disappeared, stains are almost sure to result. And, again, it should be remembered that bromide of silver is sensitive to light—even gas light—and until the whole of it has been dissolved by the hypo the plate should not see light of any sort. Curiosity will doubtless prompt us to have a look at it, but patience must overrule curiosity in this case. The chemistry of the fixing bath is not sufficiently thought out by the majority of workers. As soon as a plate is cleared of the visible, creamy bromide of silver, it is "hooked out of the fixing" and put under the tap. If we value our negatives and wish to keep them this is as great a mistake as we can make. The first action of the hypo is to convert the visible bromide of silver into invisible hyposulphite of silver, which in its turn is soluble in an excess of hypo-sulphite of soda, and should the plate be removed before this second fixing (as we may call it) is complete, our negatives stand very little chance of being permanent. It may not show itself at first, but by and by a deep yellow coloration in the film will begin to show itself, and will deepen and spread with time and repeated printings. There is no remedy for a negative so stained, but the best possible preventive is a second fixing bath made up quite fresh every time we develop a batch of plates. By this time we have developed our first six plates and filled our dippers, the first plate is ready for removal to the fresh hypo, and after each plate is developed another may be transferred until we have a dozen, which is quite sufficient for one dose of developing. The first bath of hypo is best thrown away, or rather thrown into the residue tub, and the second or fresher lot may take its place as the first fixing bath for our next batch of developing.

Washing Negatives.

The careful worker will not now think his work is ended by simply sticking the plates into the washing tank. If possible, at this stage of the proceedings, daylight should be admitted to the dark-room. If this cannot be done, a dead-white reflector should be arranged to judge the negatives by. It is practically impossible to form a correct idea of the printing value of a negative when held up to a naked gas or lamp frame. In a flat dish specially reserved for this purpose we measure out one part of saturated solution of alum, and add to it two parts water. Take the first negative from the hypo, and put it under the tap to free it from the worst of the hypo, always remembering that the longer we wash the more yellow color we shall get, providing the washing before fixation has been sufficient. After about ten seconds' washing then we hold it up to the

daylight (or the reflector) and quickly form a critical judgment as to its printing qualities. Is it a bit weak from under development, or grey (without undue contrast) from forcing? Then we return it to the tap to allow further color to form up, and when sufficient has accrued we stop the action at once by putting it into the alum bath for a few moments, during which time another may be washed. Should this one prove slightly hard from under-exposure, or thick and muddy from over-exposure, in either case washing must be cut short, and the plate inserted in the alum at once. If it is already very yellow—too yellow for its printing quality—another prolonged bath of saturated solution of alum undiluted will help matters. When all have been treated they are ready for the final washing; and if a properly constructed tank be used, having a good flow of water with the outlet at the bottom, half an hour should be sufficient. Each plate as it is taken from the washing tank should be well sponged over with a pad of cotton wool, and they may now be racked to dry. Throw the alum away. It is false economy to keep it from time to time, as the amount of hypo carried into it by the plates will eventually cause a precipitate of sulphur. Alum before fixing is recommended by some, but is a wrong plan. It entirely does away with our control over color, and unless very thoroughly washed out before fixing will lead to endless troubles. With the enormous choice that we now have in the matter of good plates we should choose another brand rather than use a plate that necessitated alum before hypo.

Reduction.

It does not of necessity follow that perfect negatives have resulted from this procedure, although if the exposure was anywhere within reason, we shall have little cause for grumbling. Still, we shall sometimes have a few negatives that are too slow for comfortable printing, or are too harsh in contrast. Therefore the action of a reducing agent must be brought to bear after the negatives are dry. Intensification should be avoided as much as possible. Rather, as before suggested, develop too far than not far enough. There are several means of reducing the density of a negative. A weak solution of perchloride of iron, followed by immersion in hypo, is one way. Howard Farmer's ferricyanide of potassium and hypo, is another. Belitzski's formula, as found on p. 241 of the Year Book, is an exceedingly good means. Another favorite is iodine and cyanide, and were it not for its poisonous qualities and rather objectionable odor, it would doubtless be much more largely used. It can be used repeatedly, and does not give that yellow stain caused by ferricyanide, unless under prolonged treatment. To 10 ounces of water add 30 grains of iodine crystals and 100 grains of potassium iodide; when thoroughly dissolved, add 1,000 grains of potassium cyanide, which will discharge the purple color of the iodine and leave a clear solution. The iodine converts the silver of the image into silver iodide and the cyanide quickly dissolves it. The two actions are practically simultaneous, and the progress of reduction is easily followed and judged. The potassium iodide is only present as a solvent of iodine, which is otherwise insoluble in water. In practical use it will be found that a less exact method of compounding the reducer has advantages. To 1 oz. of iodine crystals add 3 ozs. of potassium iodide, and just cover the whole with water, making a saturated solution. To a pound bottle of potassium cyanide add sufficient water to cover the crystals. When any of the solution is used from either bottle fill it up again with water and give it a

good shake, and it will again be a saturated solution by next time we are likely to want it. With these strong solutions reducers of varying strength are easily made—weak for negatives that are only slightly over dense, and strong for the very thick ones. The cyanide stock solution should be used in the proportion of about 7 to 1 of the iodine stock solution, and then diluted with water to the strength required. Test it on an old plate that is of no other use. Where the negative requires a general reduction all over, a dipping bath is the best way to use it. If the negative is very flat as well as thick, increase the proportion of the cyanide. In any case, if a general yellow coloration of the film occurs, it is evident that an insufficient quantity of cyanide is present—the remedy is obvious. This reducer lends itself admirably to local reduction by means of a camel's-hair brush. A little glycerine added will prevent it from running over parts which do not require to be touched, but a very little practice will enable one to use it on a dry negative without that precaution. Two or three minutes' washing will suffice, and then the plates must be immersed in a bath of saturated solution of alum 1 part, water 3 parts, to which has been added hydrochloric acid in the proportion of ¼ oz. to the pint. The final washing need not exceed ten minutes, but don't forget to use the cotton wool again.

Bromide Paper and Lantern Plates.

The fifth bottle on our shelf, containing hydroquinone, has not yet been dealt with. For bromides or lantern plates a developer compounded of soda solution, one part; hydroquinone solution, one part; metol solution, three parts; diluted with an equal bulk of water, and containing about twenty minims of bromide solution per ounce, will prove very acceptable. There is no pyro in this developer, therefore prolonged washing will not cause any yellow color or stain. It is distinctly desirable that they have thorough washing before fixation. The fixing bath should be somewhat weaker than for negatives —say, saturated solution of hypo, one part; water, two parts, with the addition of two ounces of soda sulphite to each part of fixing bath. Many a good lantern plate has been spoiled because density has not been attained before the lights began to cloud over. With the reducer above mentioned at hand, this need not be; develop for density and clear after drying.

Residues.

A few words on the subject of residues. There is an enormous quantity of silver going down our sewers from the dark-rooms of photographers, professional and amateur alike. But we need not add to the amount. Although much depreciated in value, silver is still worth something over two shillings per ounce, and an old paraffin cask can be purchased and made suitable to the purpose for a few shillings. Messrs. Pringle, the refiners, in their little pamphlet, give full instructions on the subject of preparing the cask and treating the residues. The point to which I desire to call special attention is that hypo residues are probably the richest in silver of any photographic waste. If the statement is doubted, put a penny into a hypo bath that has fixed a dozen plates; leave it there all night, and in the morning the penny will be found to be plated with an appreciable deposit of metallic silver. If possible, the residue tub should be placed beneath the sink, and, instead of the usual lead or iron piping attached to the outlet of the sink, substitute a piece of large, stout rubber tubing sufficiently long to reach the tub. When we have anything to save, be it hypo or silver washings from prints, see that this

tube is connected with the tub, and throw the valuable waste down the sink. When it has run away, remove the tubing and insert the end of it in the waste water-pipe and our sink is an ordinary sink again.--Photographic News.

LETTERS TO THE EDITOR.

To the Editor:

SIR,—I have now been photographing fifteen years for a living, and am about ready to give up. Up till three years ago I did a good business, but it has kept dwindling down, until to-day 'tis hard scratching to keep afloat. I do not consider myself an old fogey by any means. I have kept up with the times as much as my circumstances would permit. My customers seem very well satisfied, with the exception that I have received lately complaints of faded prints. The other day a brother photographer called on me, and, as misfortune likes sympathy, I told him my troubles. He laid nearly all my loss of business to faded photos. Is he right? When I say I have been receiving complaints of faded prints, I don't mean many—only a few, which seems to me small cause why my trade should have fallen so low. I have used the best gelatine paper and German card stock to be had, which have been highly recommended to me by salesmen and photographic journals. If the fading of a few photos is the cause of my bad luck, where am I wrong? You in your position must know, and I will thank you to put me on the right track.

Fraternally yours,

CAMERA.

[Our correspondent does not give his method of manipulation, neither does he send a print, so we cannot locate the trouble. Will some of our readers give him some advice? He evidently needs an application of the good "war cry" of the English convention, "Cheer Up."—ED.]

To the Editor:

SIR,—I rather expected to see something pertaining to our Association in your last issue. Is it not time we knew "where we were at" as regards time of meeting, and, above all, what classes and prizes we are to have? You give more attention, seemingly, to the American convention. Why? Yours, etc.,

READER.

[No news of the convention has reached this office. Had we received any, it would have been published same as American convention news. —ED.]

To the Editor:

SIR,—Will you kindly give me space in your esteemed journal to ask if any brother photographer can give me a cure for cheap ticket racket —same being now worked in my town. Yours, etc.,

"LEGITIMATE."

PERSONALS.

We were lately favored with a call from **Mr. C. F. Stanley**, manager of the Stanley Dry Plate. Mr. Stanley reports business this year as being considerably ahead of any year they have yet had. He is particularly pleased with the appreciation shown by the users of his plates at the decided increase in the speed and brilliancy of the Stanley plates this year.

Fred. Mulholland isn't happy unless he has something new, and his new "return" envelope with the big "Toronto" on will probably strike you ere this does. It is very convenient for customers, and the post-office boys, too.

BOOKS.

Artistic Landscape Photography. By A. H. WALL. Publishers: The Percy Lund Co., Ltd., London.

This is one of the best books on the art possibilities of photography that has been published. Mr. Wall speaks most intelligently on his subject, both to the advanced photographer and to the tyro, and teaches many lessons that we all should learn. The book will make a valuable addition to the library of the worker, and should be thoroughly read by all who aim for better work. It is well illustrated and attractively bound.

The summer double number of **The Junior Photographer,** entitled "The Junior Salon," is one of the finest issues of a photographic journal that we have seen come out of England. The attractive cover shows a Frenchy "poster" girl in red. The quality of the two hundred or more illustrations, both from a photographic and a process standpoint, combined with the very interesting reading matter, make up a number that Messrs. Percy Lund & Co. should be proud of. The price is fifteen cents. F. A. Mulholland & Co., Toronto, are the agents.

CLIPPINGS.

Carbon Process.—Those who are accustomed to work the carbon process, know very well that when the same warm water has been used for "developing" several carbon prints, the dissolved gelatine has an unpleasant tendency to work up into a froth by the inevitable splashing of the water. To skim off this froth is only to find it replaced a few moments afterwards. The following practical tip meets the case:—Take a piece of common yellow kitchen soap, and pass the moist hands over it two or three times—just enough to get a very slight lather. This, when mixed with the water, seems to dispel all gelatine froth as though by magic. If the "soap trick" be used in reasonable moderation no harmful effects are at all likely to follow. A very slight trace of soapy lather will counteract a proportionately large quantity of gelatine froth.

Pyro Developer (Cramer).

Alkaline Solution.

Water	60 oz.
Carbonate of sodium crystals (sal soda)	5 oz.
Sulphite of sodium crystals	10 oz.

A smaller quantity of sulphite will produce a warmer tone; a larger quantity a gray or bluish black tone. The alkaline solution must be kept in well stoppered bottles. If the negatives show yellow stain, make a fresh solution, or try another lot of sulphite of sodium. To prepare the alkaline solution with the hydrometer mix equal parts of the following solutions: Carbonate of sodium solution (hydrometer test 40). Sulphite of sodium solution (hydrometer test 80).

Pyro Solution.

Dissolve 1 drachm sulphite of sodium crystals in 6 ounces distilled or pure ice water, add acetic acid until the solution turns blue litmus paper red and finally add 1 ounce pyrogallic acid. Mix in the following proportions: 1 drachm pyro solution. 1 ounce alkaline solution. 2 ounces tepid water (for winter use) or, 3 to 5 ounces cold water (for summer use). If the high lights are flat, use more pyro solution. If they are too intense, use less pyro solution. For aristo negatives about one-half the quantity of pyro solution will be sufficient. If too little pyro is used, the Alkali will be in excess and cause fog.