"A WINTER AFTERNOON"
J. S. Neary, Trenton, N. J.

# Complete Self-Instructing Library of Practical Photography

VOLUME II

## Negative Developing and After-Manipulation

Including

Development of Films and Plates, Intensifying, Reducing; also Ammonia, Factorial and Tank Development.

Wet Plate and Ferrotype Processes



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*Editor-in-Chief*

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### INTRODUCTION.

After the exposure has been made on the plate or film there is still no visible image, and it is necessary to employ some means of changing the invisible image to a visible one, and, in so doing, make it possible to utilize this image as a means toward an end — which end is the finished print.

The sensitive silver salts in the emulsion of the plate or film have undergone an invisible change when exposed to the action of the rays of light — some of the particles have been affected by the light, while others remain as they were. It will be found when this exposed plate, or film, is placed in a solution composed of some oxidizing agent, called a developer, that a change takes place in the color of these light affected particles and they are thus rendered visible to the eye, and may also be built up to form an image varying in density according to the amount of the light action on the sensitive emulsion.

White objects, of course, affect the sensitive plate or film to a much greater extent than dark objects; therefore, those portions of the emulsion representing white objects will be much denser than the sections representing the shadows, and the degrees of light and shade between these two extremes (called half-tones) will be represented in that degree in which they affect the sensitive salts in the emulsion. In a general way, the developer is the agent which acts upon those portions of a sensitive substance which have been exposed to the

light. One of the most popular, as well as satisfactory, developing agents is pyrogallic acid; therefore, the fundamental training, which is to receive first consideration, will embody this developer.

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## BRIEF GENERAL INSTRUCTION.

1. **Apparatus and Material.**— It is essential, in order that accurate results be obtained and that waste material be reduced to a minimum, that you provide yourself, first with a room that is totally dark; a suitable ruby lamp; a supply of clear water; four trays; a graduate; etc.; also the necessary chemicals for mixing the developing solution, and the fixing bath. (See Pars. 8 to 13 of the Detailed Instruction on DRY PLATE DEVELOPING.)

2. **Developing.**— Prepare the developing solution according to the formula given in Par. 47, and in the manner described in Par. 49, and place in a graduate a sufficient quantity of this normal solution to thoroughly cover the plate or film. Close the dark room door and be sure that all rays of white or actinic light are excluded from the room. No light should be in evidence, with the exception of that from the ruby lamp. The developing tray should be rinsed with clear water and allowed to drain for a few seconds; then take the exposed plate and dust it carefully to remove the dust that might adhere to its surface. Now place the plate in the tray, with the film or emulsion side up. Holding the tray in the left hand, take the graduate of developer in the right hand, and, beginning at the end of the tray furthest from you, pour the developer quickly, yet carefully, over the plate, at the same time drawing the graduate towards you — in this way there will be an even "sweep" or flow of developer going over the negative and driving off of the surface of the emulsion all air. If this manipulation is carefully carried out no air-bells will form on the surface of the plate. Rock the tray gently and, although protecting the plate from the direct rays

of ruby light, watch for the first appearance of the image, which in the case of a normal exposure should be from twenty-five to forty seconds. (Before proceeding with the actual development you should read carefully the Detailed Instruction regarding the THEORY OF DEVELOPING, also the PROCESS OF DEVELOPING which follows.)

3. **Rinsing.**— After the plate has been developed it should be rinsed in clear water for a couple of minutes in order to remove all superfluous developer from the emulsion. The negative is now ready to be fixed.

4. **Fixing.**— The fixing bath should be prepared previous to developing, and should be made in accordance to the directions given in Par. 57. When the plate has been fully developed and rinsed in water it should be placed in this fixing bath until all traces of the unacted upon sensitive salts have been removed. The theory of fixing is very fully described in Pars. 26 and 27.

5. **Washing.**— When the plate has been fixed it must be washed for half an hour either in running water or in six to ten changes of water. Great care must be given to the final washing, as it is very essential that not only the hypo be removed but that all chemicals be thoroughly washed out of the emulsion, so that nothing but the metallic silver image remains.

6. **Drying.**—The plate should be dried in a draught if possible, yet be sure there is no dust in the air, for any particles which come in contact with the gelatine emulsion will adhere to it. The temperature of the room should not exceed eighty degrees. It is advisable to have the plate dry in from two to four hours.

7. **Preserving the Negative.**— When the negative is dry it should be placed in a negative preserver (manila envelope) and full data recorded on the outside of the envelope. Important items which might be included in this data are: subject, brand of plate, weather conditions, make and speed of lens, size of diaphragm, exposure, developing agent or developing formula, and other information of value for future reference.

## CHAPTER II.

# DETAILED INSTRUCTION.

### DRY PLATE DEVELOPING.

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NOTE TO BEGINNERS.—In the following instruction wherever the word "plate" is used "film" may be substituted.

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8. **Dark Room.**—The first point to consider in the developing of the dry plate is the room in which you are going to develop, commonly called the dark room. This is somewhat of an erroneous term, as the room must not necessarily be dark, as the term would imply, but only in a chemical sense. By a dark room we mean a room which, when the door is closed, is free from any actinic light. The only light in the room must be produced by the dark room lamp, or window, commonly called the ruby light; a combination of ruby, orange and yellow, which is non-actinic, but only to a certain extent. The dry plate of to-day is more or less affected by all colors. You should, therefore, never place a plate while changing or developing too near your ruby light. You can examine your plate occasionally by holding it up close to the ruby light, but only for a few seconds at a time.

9. **Dark Room Light.**—Besides the quality, the quantity of light must be considered. You should always employ artificial light, as daylight is apt to vary. If you are not going

to use a regular dark room lantern, over your sink you should have a window. In this window place your combination of ruby, yellow and orange glass. On the outside place a shelf for the light. On this you can place your lamp or adjust the gas jet or electric light. This will keep the heat out of the dark room.

10. **Size of Dark Room.**—In a professional studio where a large amount of developing is to be done, the dark room should be fairly large. It is a mistake to suppose that a small closet or cupboard will do, as it would be extremely injurious to the health of those who were compelled to remain in such a small room for any length of time. For the amateur who only develops a plate at a time, a small dark room is perfectly safe and practical; but in either case the dark room should be kept perfectly clean and there should be a place for everything and everything in its place.

11. **Ventilation.**—In preparing a perfect dark room, ventilation should also be considered. There should be an outlet for foul air at the top of one of the walls. It should be so arranged that the foul air can be let out without letting in light. (See Illustration No. 1.)

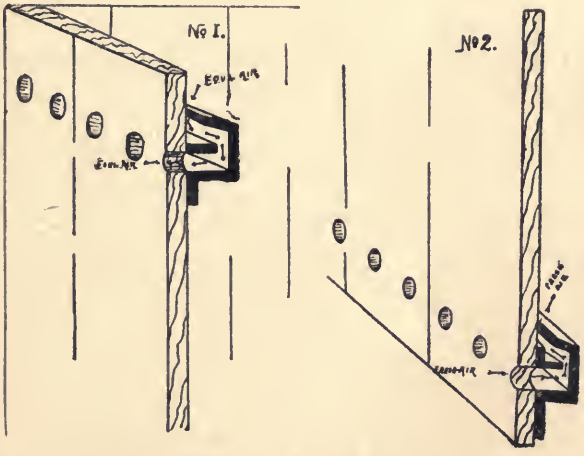


Illustration Nos. 1 and 2
Simple Method of Ventilating a Dark Room
See Paragraph No. 11

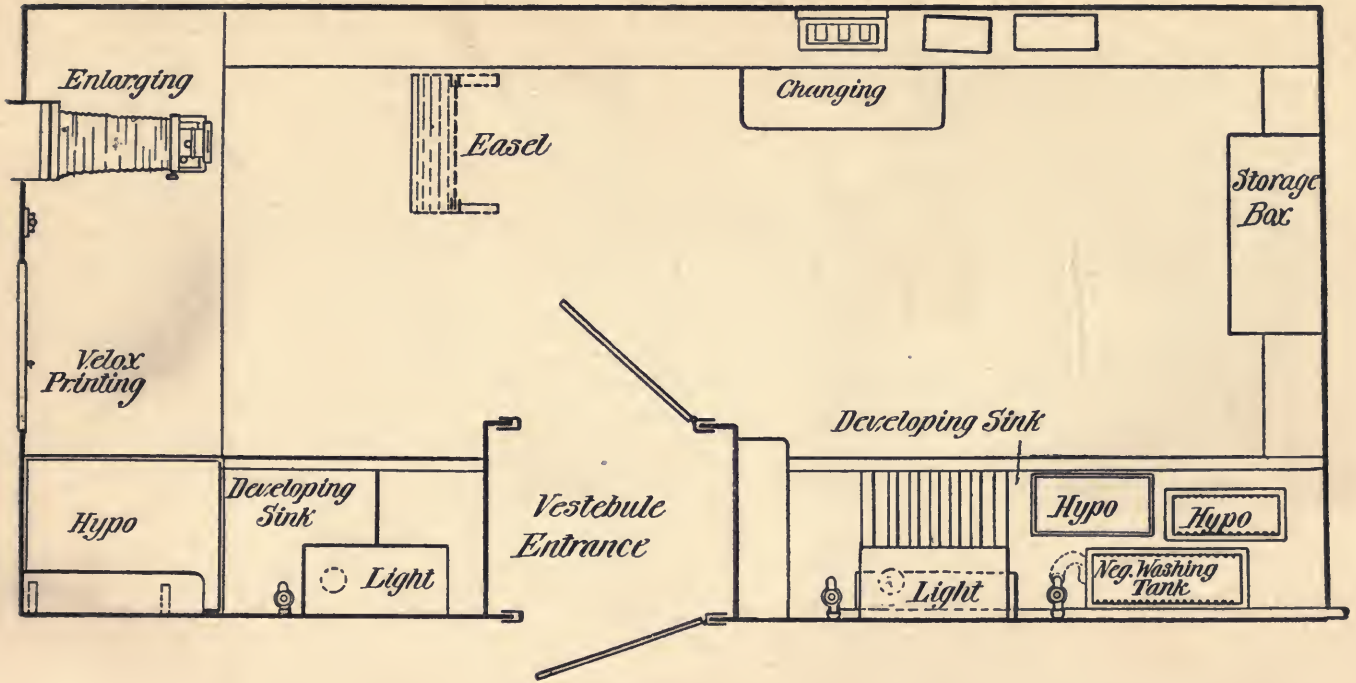


Illustration No. 3
Floor Plan of a Convenient Dark Room
See Paragraph No. 14

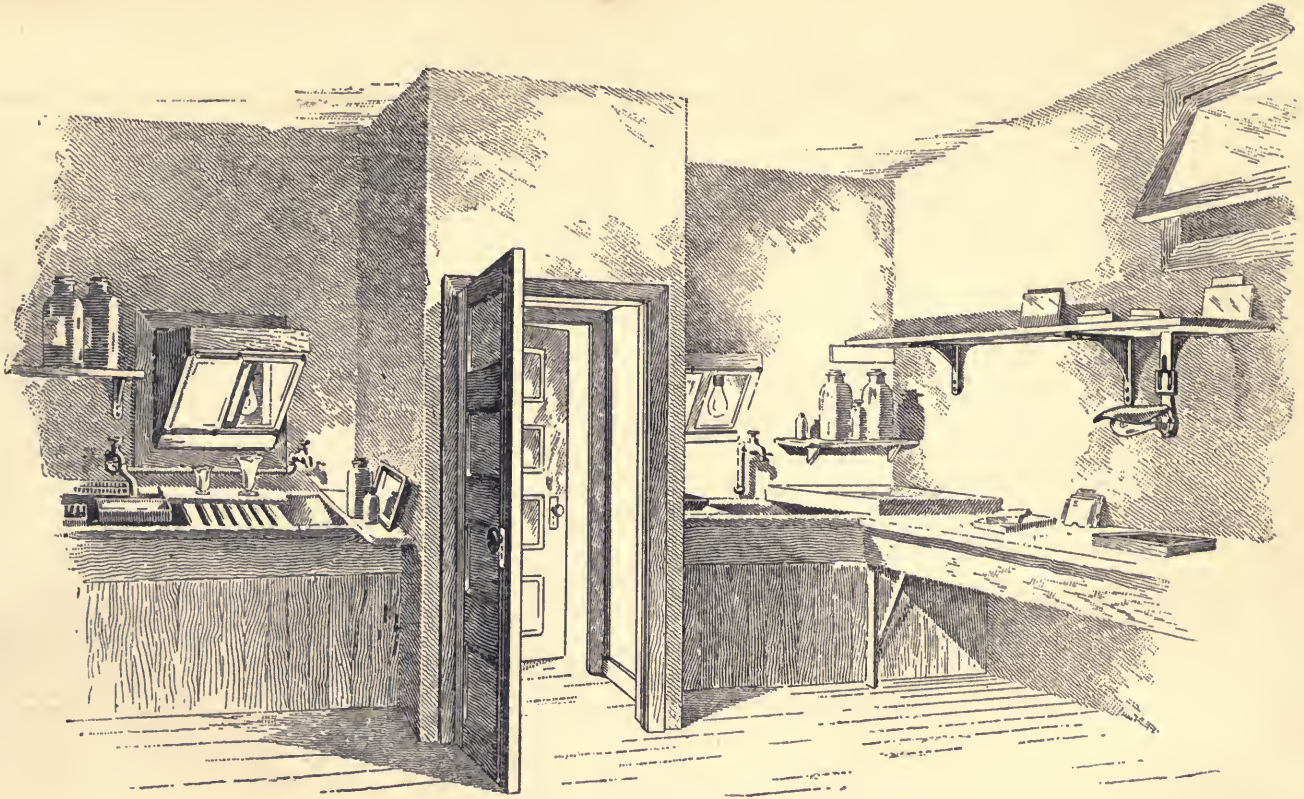

Illustration No. 4
Sectional View of Convenient Dark Room
See Paragraph No. 15

There should also be an inlet for the fresh air, and this may be provided by piercing a number of holes at the bottom of the door and arranging a hood over them. (See Illustration No. 2.)

12. **Developing Outfit.**—The room should contain, besides the sink with a tap above it, a table and several shelves, four developing trays, one fixing box, one washing box, one 16-ounce graduate, one 4-ounce graduate, one minim glass, one hydrometer, one stirring rod; several large mouthed glass stoppered bottles, one 64-ounce for sulphite ot soda stock, one 64-ounce for carbonate stock, one 36-ounce for pyro stock and one 36-ounce to hold old developer, one camel's hair dusting brush, a pair of scales and negative racks.

13. **Chemicals.**— The following chemicals are necessary: Carbonate of Soda, Sulphite of Soda, Hypo-Sulphite of Soda, Pyro, Sulphuric Acid, Nitric Acid, Red Prussiate of Potash, Persulphate of Ammonia, Bromide of Potassium and Bichloride of Mercury.

14. **A Convenient Dark Room.**— The accompanying illustration No. 3 gives the floor plan together with the dimensions of a very convenient combination dark room. This room can be used for all the different photographic processes requiring a room which is totally dark. The size of the room is 10 x 20 feet. Access to the room is made through a vestibule double door without admitting any light. Both doors are fitted with heavy spring hinges so that when entering or leaving, the first door is closed before the second one is opened.

15. **Developing Sink.**— Space has been allotted in each section of the room for certain particular work, such as the loading of the plate holders, developing and fixing plates, making gaslight prints, making bromide and negative enlargements, etc. The side of the room including the vestibule entrance and the two large sinks on either side is illustrated in Illustration No. 4.

The sink to the left which is nine feet long, is used for developing and on account of its size is very convenient for the general manipulation of plates and films. Across the top and on a level with the sink is arranged a movable rack

twenty-four inches long by the width of the sink, upon which to rest the developing tray while developing. This rack is made of one-inch square strips.

16. **Washing Box.**—The washing box for 5 x 7 and 8 x 10 plates should be placed in this sink and a very convenient one may be easily constructed of one-inch pine lumber

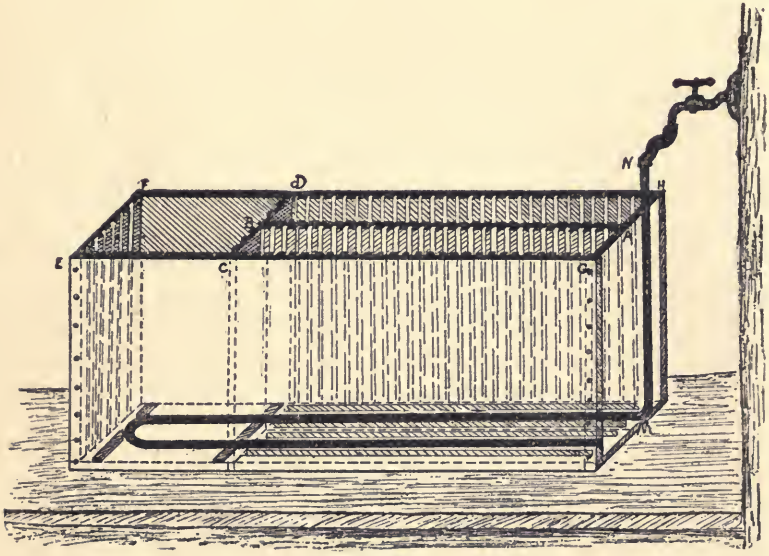


Illustration No. 5
A Plate Washing Tank
See Paragraph No. 16

according to the following instructions:—The length of the box on the inside should be thirty inches, while the width should be eleven inches. Nine and one-half inches from one end of the tank place the partition *C*, *D*, and equally divide lengthwise the remaining larger section by the partition *A*, *B*. Both sides of this partition, *A*, *B*, should contain grooves one-fourth inch deep and one-half inch apart and the side of the box *H*, *D*, and *G*, *C*, should also be grooved as well as

the end *B*, *F*, and the side of partition *C*, *D*, which faces the smaller section of the washing box. There will now be three divisions, two to accommodate 5 x 7 or 4 x 5 plates, and another for 8 x 10 plates. A U-shaped piece of lead pipe, perforated on the sides with small holes, should be placed in the bottom of the tank before inserting the partitions. The pipe should enter the tank at one end at the point marked *M*, and if properly placed it will come in the center of each of the divisions made for 5 x 7 plates. On each side of the pipe is placed wooden strips for the plates to rest on. On the outside of the box at *M*, the pipe turns upward and extends a few inches above the top of the box and is connected to a faucet with a short piece of rubber hose. (See illustration No. 5.) In addition to the washing box there are two rubber hypo tanks — for fixing 5 x 7 or 8 x 10 plates.

17. **Developing Light.** — The developing light is constructed so that the front is bevel shaped, for in this way it throws the light downward upon the developing tray. The front of this light has two sliding windows, one containing ruby glass and a sheet of P. O. paper, while the other frame is fitted with ground-glass. During development the ground-glass may be shoved back out of the way and the ruby light used, but when development is completed the ruby light frame can be slid back and the ground-glass frame drawn over in its place and the negative examined by it.

18. **Shelving.** — A very important item in any dark room is the proper arrangement of the shelves. These should be placed in convenient location and each shelf contain certain articles. For instance, the shelves over the developing sink should contain the developing solutions and other bottles, graduates, trays, etc., while the shelving at the end of the room where gaslight prints, bromide enlargements, etc., are made, should be reserved for paper and negatives and those over the changing light for storing dry plates, plate holders, etc. Always keep the same material on the same shelf and in exactly the same location so that when you have formulated this system you will be able to locate any material that you might desire, even though the room is in total darkness.

19. **Department of Printing and Developing.**—On the right hand side of the vestibule is another large sink over which is placed a ruby light similar to the one previously mentioned. The glass in front of this light is, however, of an orange color suitable for developing papers, but the window is fitted in a similar manner to the front of the negative developing light, so that white light may be admitted when desired. The developing is done at the left end of this sink, while at the right hand, in the corner, is placed a large hypo tray 25 x 30 inches in size. This tray is large enough to hold prints 20 x 24 inches and may be used for fixing bromide enlargements as well as velox and other developing papers. Across the narrow end of this room is placed a table three feet deep. Near the center, and far enough away from the developing sink, is a thirty-two candle power incandescent electric bulb, which is operated with a switch and is used for printing gaslight papers. A tin reflector is placed directly over the electric bulb. Directly over this light near the ceiling is a ventilating window which may be opened when the dark room is not in use in order to allow a thorough change in the atmosphere of the dark room.

20. **Enlarging Department.**—The side of the room opposite the developing sinks and the vestibule is shown in illustration No. 6. This side is shelved and used for storing dry plates, negatives, etc. It is also used for making bromide and negative enlargements. Directly opposite the vestibule entrance and over the drop-table, is a changing light. Underneath this light the plate holders are loaded and unloaded. The light falls directly upon the plate holder, thus enabling one to see sufficiently to load and dust the plates. At one side of the ruby light, under the upper shelf, is a storage box for 5 x 7 or cabinet size exposed plates. On the front of this box is a heavy lid attached at the top with a heavy spring hinge, which keeps the lid closed tightly after placing the exposed plates in the box In order to facilitate the loading of plate holders, to the right on the changing shelf are two boxes containing dry plates (taken from their original pasteboard boxes),

ready to be placed in the plate holders — one box is for 5 x 7 and the other for 8 x 10 plates.

21. **Bromide and Negative Enlarging.**— When this side of the room is used for negative and bromide enlarging, the table employed for changing plates is dropped in order to make room for the enlarging easel. The enlarging camera is arranged on the previously mentioned table at the end of the room. An opening is cut in the partition to admit the condensing lenses, which are fitted in the wall and the camera is fitted flush to this partition. The electric arc light used for enlarging is hung on the outside of the wall and is operated by a switch from the inside. As the length of the room is twenty feet, an enlargement of any size can be made.

22. **Theory of Developing.**— We will next consider the process of developing and the action of the developer upon the exposed plate. When you have made your exposure and placed your plate in the developer, the developing agent builds up and renders the latent image visible. When the plate was exposed in the camera no visible change took place on the sensitive surface, still some parts were affected by the light, while other parts remained unchanged.

23. When the plate is placed in the developer it may merely change the color of the light affected parts, and render them visible to the eye, or it may build up an image on the plate. In other words, the developer is the agent which exerts an action upon the portions of a sensitive plate which has been exposed to the light, and has no effect on the parts which have not been exposed.

24. In the pyro developer the action of the pyro is assisted by an alkali, such as carbonate of soda. When you expose a dry plate to the light you have a certain amount of silver sub-bromide. Immerse this plate in plain pyrogallic acid, and there will be little or no change, but if a small quantity of alkali is added, the image will begin to develop and the plate will blacken rapidly, forming a metallic silver; therefore, it is necessary that a certain amount of alkali must be used in the developing of the plate.

25. The action of the carbonate of soda is to open the pores of the emulsion. If the action is too rapid (and this would be the case if too strong or too much carbonate of soda was used) the pyro would penetrate the emulsion too rapidly and too deeply, and would then stain the film, and you would produce a yellow negative. To offset this and prevent staining, sulphite of soda is added. The carbonate is termed the accelerator and assists the pyro in developing, while the sulphite is the preservative of color; therefore controls the color of the negative.

26. **Theory of Fixing.**— The agent universally adopted for fixing both plates and paper is hypo-sulphite of soda. A sensitive emulsion of chloride, or iodide of silver, on which has been formed an image, either with or without the aid of the developing agent, must pass through this process to render it indestructible by diffused light. It is true that the image itself is sufficiently permanent, and it cannot be said, in correct language, to need fixing. The unchanged silver salts surrounding it are still sensitive to the light, and tend to be decomposed in their turn, and so the picture is lost. It is, therefore, necessary to remove these salts by applying some chemical agent capable of dissolving them. In order that a chemical may be employed with success as a fixing agent, it must produce no injurious effect upon the silver salts which have been affected by the light. Hypo-sulphite of soda is employed not only on account of its having these safe qualities, but because it is economical. The fact that the silver contained in an ordinary fixing bath is present in the state of hypo-sulphite must be borne in mind, because this salt is liable to undergo peculiar chemical changes. Iodide of silver is dissolved by hypo more slowly than chloride of silver, and the amount eventually taken up is less. This is explained in the following manner: —

During the dissolving of iodide of silver, iodide of sodium is formed, and this has the effect of acting as a stop to the fixing. In other words, it retards the action of the hypo-sulphite of soda. The time occupied in fixing will, of course,

vary with the strength of the hypo-sulphite of soda solution employed.

27. The process of fixing is simply the dissolving away of the sensitive salt unacted upon by the light. We recommend the plain hypo bath for the following reasons: The addition of any acid to the hypo-sulphite of soda may cause chemical changes. It first displaces the chemical hypo-sulphurous acid from its combination with soda. This acid begins to decompose, and splits up into the sulphurous acid, remaining dissolved in the liquid, and giving the characteristic odor of burning sulphur. Sulphur which separates in a finely divided state forms a milky deposit. In other words, sulphurization has been produced, and a plate fixed in this bath will discolor, and the image will probably fade away entirely in time. It will also harden the emulsion, and it is next to impossible to doctor successfully a plate fixed in a bath of this kind.

28. **Discoloring of Hypo Bath.**—A strong fixing bath should always be used for fixing plates. To more fully understand the reasons for this, let us study the peculiar properties of this salt (hypo-sulphite of soda). Suppose we were to dissolve sixteen grains of nitrate of silver in one-half ounce of water and twenty-four grains of hypo-sulphite of soda in one-half ounce of water, and then add one solution to the other. A dense deposit of hypo-sulphite of silver would immediately be formed and rapid changes would take place in this deposit; first, white and curdy, next canary color, then a rich orange-yellow, afterwards a liver color, and finally almost black. This change is due to the sulphuric acid formed by the mixing of the silver and hypo-sulphite of soda. The black deposit is sulphide of silver, the yellow and orange being in the early stages of decomposition. This will explain why a plate fixed in a weak hypo bath is sometimes covered with a brown deposit of sulphide of silver and the hypo bath discolors so rapidly, whereas if a full strength hypo bath has been used the plate will be free of the deposit and the bath will remain clear much longer.

29. When you place your developed plate in the fixing bath you are carrying a certain amount of silver into the hypo.

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If, therefore, your hypo bath is weak the silver in the plate overpowers the hypo-sulphite of soda and sulphide of silver is formed and the same chemical action takes place as when you mix the silver with hypo-sulphite of soda. A strong hypo bath is, therefore, recommended. The hypo is also more easily eliminated when a strong bath is used.

30. **Developing.**—A plate you believe to be properly exposed should be started in a normal developer. A correctly exposed plate can be completely developed with the solution of normal developer given in this instruction without any alteration whatsoever. It is advisable to always save the last developer used, pouring it into a large mouthed bottle, placing a cover over the bottle to protect it from dust and also from the air. The developer will become discolored, but this need not alarm you, as it will make no difference for the purpose it is intended,—that is, the developing of over-exposed plates. However, it should only be kept from day to day. The developer which you use once as your fresh normal developer, should be used the next time as old developer.

31. It is well to use two trays for developing. Into one tray decant the clear solution of old developer. By clear solution we mean that which is free of particles of film or dirt, but not clear in color. Add to this one-third fresh normal developer. The other tray use for fresh normal developer.

32. **Restraining Development.**— If a plate flashes up quickly, indicating over-exposure, place it in the tray of old developer at once, rocking the tray quickly so that the bromide in the old developer, which was liberated from the emulsion of plates previously developed, will penetrate the plate at once, and check development. The bromide acts as a restrainer, keeps the shadows clear, and allows the highlights to build up. The plate will develop up much slower in this bath, as the bromide acting on the shadows permits the highlights to build up first. Unless plates are very much overtimed, we advise using no other means of restraining than those described above.

33. If you have no old developer on hand, and upon placing the plate to be developed in normal developer it shows

indication of over-exposure, then remove the plate immediately from this bath and if you have a tap of water, run the fresh water over the plate quickly and at once drop four to six drops of a ten per cent. solution of bromide of potassium into the normal developer. Then return the plate to this tray, and conclude the development.

34. **Bromide Solution.** — To make a ten per cent. solution of bromide, dissolve one ounce of bromide of potassium in ten ounces of water. Place this stock solution in a twelve-ounce bottle with cork stopper, and split the cork to the center. If it fits too tightly you may cut a little notch in the side and again insert the cork tightly, and you will find when the bottle is turned bottom side up, the solution will drop from the cork very nicely and will be a very convenient way for measuring the required number of drops quickly. The bromide of potassium when used in the developer prevents oxydization of silver in those parts of the sensitive plate on which the light has not acted. For example, the shadows. It also retards the oxydization on the parts on which the light has acted. For instance, the highlights, white draperies, etc., etc. If one is quite sure that a plate is over-exposed, a drop (or no more than two drops) of bromide can be added to the normal developer before placing the plate into it to be developed. This will slightly restrain the shadows and a more brilliant negative will be the result. A plate placed in a fresh developer, which from the start contains two drops of bromide, will restrain the plate more than six drops of bromide if added to the developer after the plate has been once started in normal developer.

35. **Action of Old Developer.**—When a gelatine-bromide plate (dry plate) is exposed to the action of light, the sensitive film undergoes a change, the elements of which it is composed (silver and bromide) lose their affinity for each other and a state of incipient decomposition is set up. If the exposed plate is then subjected to the action of a developer, for instance, pyro, and all developers have a reducing power over modified silver bromide, the action of the light is continued and intensified by further decomposition of the molecules of

the film impressed by light. This continuing of action constitutes development, and by it the image impressed on the film is made visible, a dark deposit of silver resulting from the application of the developing agent in those parts of the silver affected by light in proportion to the intensity of the light action. When the developer is too strong, we have a general reduction of silver over the entire sensitive surface, resulting in what is commonly called chemical fog. The bromide in the sensitive dry plate is really bromo-iodide of silver; originally it was bromide of potassium and iodide of potassium, but when they became a part of the nitrate of silver, they, by decomposition, became bromo-iodide of silver.

36. The principal difficulty, therefore, to overcome in developing an over-exposed plate is chemical fog. While bromide added to the normal developer will prevent this to a certain extent, yet the development is prolonged considerably and the action of even the ruby light upon the plate has a tendency to fog, while if old developer was used (one which has become thoroughly ripened and which contains bromide liberated from previous plates developed) the color of this developer over the plate protects it from the continuous action of the light during prolonged development and with less likelihood of fog. Therefore, the use of old developer is preferable to normal developer with fresh bromide added.

37. **Snap and Crispness.**— It is well after a plate has been developing in the old or restrained developer for some time, to place it in a fresh normal developer in order to give snap and more crispness, always being careful to rock the tray. The rocking of the tray must not be all in one way; first rock from you, and then from side to side. The action of the normal developer is apt to be quite rapid; therefore, the plate must be watched very closely and when the proper strength and snap have been obtained, remove the plate at once and rinse thoroughly and then fix.

38. **Under-Exposure.**— In case the image appears slowly and with contrast, shadows remaining clear, highlights building up slowly, you will readily understand that the plate is under-timed. Then immediately place it in a tray of plain

water, cover the tray and allow the plate to remain in the water for say ten minutes, after which conclude developing in normal developer. We advise covering the tray so as to keep not only the light of your ruby lamp from the plate, but also to prevent the air striking the developer, as this would have a tendency to oxydize and also change the temperature.

39. **Extreme Under-Exposure.**—If the plate shows signs of extreme under-timing, make a new developer weak in pyro, using one-half the quantity of pyro and the regular amount sulphite and carbonate of soda and double the amount of water. In making up a developer with less of the developing agent, you will prevent the highlights from becoming too dense and harsh, and the weak developer will give the shadows an opportunity to gain in strength and detail. Conclude the developing in this bath instead of with normal developer. Your resulting plate will be clear in detail, with no harsh highlights.

40. **Judging When Plate Is Developed.**—The greatest difficulty in developing a plate is to know just when to stop. Conditions have so much to do with the proper developing of a plate that it is hard to state exactly how to tell, under all circumstances, when to stop developing. A properly timed plate is fully developed and carried far enough when the contrast between the highlights and shadows is as you would desire it, and as it appeared on the ground-glass, taking into consideration that the plate loses some of its strength in fixing. Some brands of plates fix out more than others. For instance, a Seed plate will lose two degrees in a hypo bath, while others will lose one shade of density; so when judging if the plate is fully developed, you must bear in mind the brand of plate used and develop accordingly.

41. In considering an over or under-timed plate as to when it is fully developed, you must judge it for the same result as one properly timed, taking into consideration whatever effect the over-timing or irregular conditions may have upon it. Should the plate be slightly over-timed it will thicken (blacken) up more rapidly than if correctly exposed, and, therefore, must be carried farther, by allowing to remain in

the developer until the desired contrast — even in a very dense plate — is visible.

42. If the plate were removed from the developer with an even density throughout, but with no distinction between highlights and shadows, and then fixed, while it may be strong, it will lack the necessary contrast. Such plates must, therefore, be carried to the stage where the contrast between highlights and shadows is visible even in the most dense plate. The plate so developed can then be reduced and a good printing negative made of it.

An over-exposed plate under-developed will appear very thin and full of detail when fixed, but will have no printing quality, so it must be carried far enough to produce this result and stopped there.

43. Upon examining the plate (by looking through it, holding it up to the ruby light) during development, if you are in doubt as to whether the proper density has been obtained, you can, by looking at the back for the image, see how far through the film the developer has penetrated. If in looking through you find the proper contrast and the image also shows fairly clear on the back, you may know your plate is sufficiently developed. Do not depend, however, on looking at the back alone, for in some cases plates will be fully developed before the image appears on the back at all. This greatly depends on the thickness of the emulsion, which varies in different brands and also on the length of exposure.

44. For a plate that is slightly under-timed, necessitating weak, slow development, the image will appear on the back at an early stage and more distinctly than in a normal exposure in which the image may show very dimly or not at all, even when completely developed. You will notice that the highlights show through the film first, and if in looking through the plate the details appear weak, continue development until they are brought out some on the back.

45. **Double Coated Plates.**—The beginner invariably under-develops double coated plates, as the extra emulsion adds to the general density, misleading one's judgment. For these plates the factorial method of development described in paragraphs 459 and 695 is recommended.

## GENERAL NOTES ON DEVELOPERS.

**Pyro.**— Too much pyro clogs the whites. Too little pyro: slow development, lack of brilliancy.

**Alkali.**— Too much alkali: quick development, dense, flat negatives. Foggy and granular. Too little alkali: slow development, contrast.

**Sulphite.**— Too much sulphite: cold, gray tones. Too little sulphite: warmer tones, inclined towards yellow.

**Water.**— Too much water: thin highlights, plenty of detail but lack of snap and strength. Too little water: more contrast.

**Temperature.**— Normal, 65° to 70° Fahr. Higher temperature, intensity and likely fog. Lower temperature: flatness, lack of snap.

**Drying Negatives.**— The warmer and closer the atmosphere in which the negative is dried, the more dense it becomes. Wherever possible, negatives should be dried with an electric fan, or under some breeze. The quicker they dry, within limit, say within a few hours, the finer the grain will be.

## NATURE OF CHEMICALS USED FOR DEVELOPING WITH PYROGALLIC ACID.

46. **Sulphite of Soda.**— Transparent crystals, also granular and dried (anhydrous) very soluble in water, two parts of crystal are equivalent to one part dried (anhydrous or granular). Chemical action, neutral or slightly alkaline. Do not confuse sulphite with sulphate of soda.

**Carbonate of Soda.**— Commonly called washing soda. Transparent crystals, also granular and dried (anhydrous). Very soluble in water, two parts of crystals are equivalent to one part dried (anhydrous or granular). Chemical action, strongly alkaline.

**Pyrogallic Acid.**— Developing agent. A white crystaline substance, poisonous, although termed an acid its action is neutral.

**Sulphuric Acid, C. P.**— Chemically pure. A colorless, oily liquid. Commercial sulphuric acid is yellow or brown and should never be used. CAUTION:— Never pour water into sulphuric acid, as this would be most liable to cause an explosion. Always pour the acid into the water. Coming in contact with flesh it will burn. Do not confuse sulphuric acid with sulphurous acid.

**Bromide of Potassium.**— Colorless crystals, dissolves readily in water.

**Hypo-Sulphite of Soda.**— Commonly called Hypo. (Thiosulphate of Sodium.) Put up in crystals and granular form, colorless.

**Nitric Acid, C. P.**— (Chemically pure.) A colorless liquid of a pungent, suffocating odor, is a powerful dissolvent of all metallic bodies, and if coming in contact with the flesh will burn.

47. **Pyro Formula.**— STOCK SOLUTION, No. 1:

| | |
|---|---|
| Water | 24 ounces |
| Pyro | 1 ounce |
| Sulphuric Acid, C. P. | 10 drops |

STOCK SOLUTION, No. 2:

| | |
|---|---|
| Sulphite Soda, Hydrometer Test 70, or, if by weight, | |
| Sulphite Soda (crystals) | 2 ounces |
| Water | 7 ounces |

STOCK SOLUTION, No. 3:

| | |
|---|---|
| Carbonate Soda, Hydrometer Test 40, or, if by weight, | |
| Carbonate Soda (crystals) | 2 ounces |
| Water | 10 ounces |

When making up solutions by weight and anhydrous carbonate or sulphite of soda is used one-half the amount is required.

The Stock Solutions of Sulphite and Carbonate of Soda can be made up in any quantity, and they should be kept in a corked bottle.

48. Anhydrous sodas have no water in their composition; therefore, they are twice as strong as the crystal, which has

water in its composition. It is advisable to use anhydrous, or if the crystal is used be sure and get pure crystals. Sodas should be purchased in sealed packages or bottles; never in loose quantities.

49. **To Develop,** take one ounce of No. 1, one ounce of No. 2, one ounce of No. 3, and add six ounces of pure water in cold, and eight ounces in warm season. The action of the developing agent (pyro) is more rapid in warm than in cold weather. In warm weather the emulsion softens more readily, and the action of the pyro is more rapid; therefore, if the same strength developer was used in warm as in cold weather the negatives would thicken up too rapidly, resulting in harsh, strong negatives. This is overcome by adding more water to the developer. In cold weather the emulsion remains firmer, and the pyro does not affect it so readily; therefore, it is necessary to use a stronger developer — consequently less water is used than in warm weather.

Developer should never be used but once, whether one plate or a batch of plates are developed in a tray. After a plate or a tray full of plates have been developed, that developer should be discarded, or poured into the second tray to be used as a restraining bath. All normally exposed plates should be started developing in a fresh bath.

In preparing a pyro stock solution, first place the water in the graduate, then add the sulphuric acid, and last add the pyro. If the water used is strongly alkali, and the chemicals were not mixed in the order given, this stock solution would discolor very rapidly.

50. **Proper Color of Plate.**— If the plate when fixed is too yellow, strengthen the sulphite; if there is a lack of color, the negative is a blue-gray, reduce the strength of the sulphite stock solution, but use the same quantity. The proper color of a plate is of the gray order, with the least tinge of brown.

51. **Chemical Action.**— Always bear in mind that sulphite of soda regulates the color-value in the plate; carbonate of soda produces detail; and pyro being the developing agent, gives strength and contrast. If the plates are yellow

you will understand that the sulphite is not strong enough. For example, we will say you are using sulphite at seventy test, and your plates are quite yellow. Strengthen it to perhaps eighty hydrometer test, all other chemicals remaining as they are. Regulate the color of the plate entirely by the strength of the sulphite of soda.

52. You will find it rarely, if ever, necessary to change the strength of the carbonate of soda. If, however, you find upon testing the water that it is strongly alkaline, you may find it necessary to change the strength of the Carbonate Stock Solution, that is, make it weaker. For if the water you are using is strongly alkaline instead of being neutral, and the regular amount or strength of alkaline solution (carbonate of soda) was used, you would have more alkali than necessary to balance the developer. If there is too much carbonate (or alkali), you will find the emulsion of the plate will be rather grainy. In such a case reduce the strength of the carbonate of soda very slightly, say five degrees, and this effect will be overcome. The pyro is used for strength. If the plate develops contrasty, use less of No. 1 (Pyro Stock Solution), but usually the formula given will need no altering whatever.

53. **Use of Hydrometer.**—A hydrometer is an instrument for determining the specific gravity of liquids. The strength of the liquid is determined by the depth to which the hydrometer sinks in the solution. It has on it a series of numbers from ten to eighty. When testing the strength of solution correction must be made for variations in temperature. If the liquid is cold it may allow the hydrometer to sink lower and the strength it would register might appear weaker than it is; if warm, it would be just the reverse. Do not prepare chemicals by weight; use the hydrometer for testing them and you will always have uniform results.

54. If chemicals in crystal form should dry to a powder by exposure to air, the weight would be altered, although the strength of the original quantity would remain the same; consequently a solution made by dissolving one ounce of the dry

powder would be stronger than one ounce of crystals in the same quantity of water. Also chemicals of different brands, and even of the same brand but procured at different times, are seldom of uniform strength, and if prepared by weight instead of by hydrometer test, you will be apt to meet with frequent failures.

55. **Alteration of Formula for Different Brands of Plates.**— The formula for developing given herein will work well with any brand of plate by following the above directions. If you are using a brand of plate that will strengthen quickly use more water. If, on the contrary, you cannot get the desired strength, reduce the amount of water, thus making your developer stronger and the developing agent (pyro) will act more rapidly.

56. For Seed, Standard and Stanley Plates use according to formula; for Cramer (more pyro should be used) ten drams of the Pyro Stock Solution No. 1 and nine ounces of water; but for Hammer Plates (use less pyro) only six drams of Pyro Stock Solution No. 1 and eight ounces of water. Sodas remaining the same for all brands of plates.

57. **Fixing Bath.**— For fixing bath use plain hypo and water, one pound of hypo to two quarts of water, or testing sixty by hydrometer, and during hot weather keep the bath cool. Allow the plates to remain in this bath about twenty minutes, or about ten minutes after all whiteness (bromide of silver) has disappeared. Should plates show a tendency to frill in hot weather, prepare a hardening bath composed of one-half ounce of ground alum to one pint of water. Immediately after fixing, rinse the plates well and then immerse them in this hardening bath for one minute, or until the film becomes hardened, and transfer them to the washing box. The hypo bath will discolor after using a few times, but this need not alarm you, as the hypo bath is good as long as it will fix plates in a reasonable length of time, say fifteen minutes, and not stain them. Always rinse your plates carefully before placing them in the hypo; otherwise you will be carrying the developer into the hypo, and this is what causes the discoloration.

58. We advise the use of the best sodas. Do not buy the commercial goods. Pure crystals, or anhydrous sodas are the best.

59. **Weights and Measures.**— When not using the hydrometer in making up your solutions, the Apothecaries' Weight and measures should be used.

APOTHECARIES' WEIGHT.

| | |
|---|---|
| 20 grains — one scruple | 20 grains |
| 3 scruples — one dram | 60 grains |
| 8 drams — one ounce | 480 grains |
| 12 ounces — one pound | 5760 grains |

FLUID MEASURE.

| | |
|---|---|
| 60 minims | one fluid dram |
| 8 drams | one fluid ounce |
| 16 ounces | one pint |
| 8 pints | one gallon |

60. **Preserving the Pyro.**— The Pyro Stock Solution should be kept in a tightly corked bottle, using a glass stopper (if possible, a brown or yellow bottle preferred). If a plain glass bottle is used, wrap it with dark paper, and place in a dark, cool place in your dark room. It should be shaken each day to keep the sulphuric acid thoroughly mixed with the pyro and water.

61. The formula given herein for developing can be adjusted to any class of exposure. By diluting with water for under-exposure, and by carrying farther in the normal developer for over-exposure, you have control of the plate under all reasonable conditions.

## CHAPTER III.

## DIFFICULTIES—DRY PLATE DEVELOPING.

62. **Plate Slow in Starting to Develop.**— This difficulty you can overcome by being careful that your developer is not too cold. The temperature should never be under sixty nor above seventy degrees Fahr. Insufficient carbonate of soda or too weak carbonate and poor quality of soda will slow the development. Prepare your sodas by hydrometer test. Always bear in mind that the carbonate of soda opens the pores of the emulsion on the plate and allows the developing agent (pyro) to act; therefore, if there is no carbonate of soda, or if it is extremely weak or of poor quality, the plate would develop very slowly. If the plate refuses to develop at all, you will find you have omitted either the Carbonate or Pyro Stock Solution. If the plate is extremely under-timed it will naturally start slowly. (See Chapter IV, DEVELOPING UNDER-EXPOSURES.) Slow developing is not a bad fault, however, as it is better to have your plate start gradually than to have it start fast. Starting slowly will enable you to better judge whether your plate is under or over-exposed, and the slow action of the developer will enable you to treat the plate before it gets beyond your control.

63. **Lack of Detail in Shadows.**— If you develop your plate according to its exposure you will be able to overcome this difficulty, providing of course, that the plate is not too badly under or over-exposed. If your plate is under-exposed and you treat it as such, you will produce more detail than if you developed it in the ordinary way; but of course if badly under-exposed you will not be able to get a great deal of detail in the shadows, no matter how you alter the developer. In case of an under-exposure, the first thing to consider is how to prevent the highlights becoming harsh and contrasty, and at the same time producing detail in the shadows. The developing agent (pyro) must, therefore, be weakened. In case of an ordinary under-exposure, simply transferring the plate into fresh water for ten minutes and then returning it to the normal developer will generally produce detail in the shadows.

On the other hand, if the plate is badly under-exposed a new developer should be prepared at once, and this must then be made according to your instructions on DEVELOPING UNDER-EXPOSURES, Chapter IV, using only half the quantity of developing agent (pyro), but the same amount of sodas and double the quantity of water. If the plate is over-exposed you would naturally think there would be plenty of detail in the shadows. The exposure has provided this detail, but in over-exposing a chemical fog is produced, and if the plate is not treated as over-exposed you will produce gray, weak, foggy shadows and there will be no strength to the detail. A plate of this kind must, therefore, be developed in a developer which contains a restrainer. Ordinarily, by transferring a plate from the normal developer to the developer in which plates had previously been developed, will restrain the shadows and prevent them from fogging over; but in case of extreme over-exposure the plate must be specially treated with bromide. (See Chapter VII, DEVELOPING OVER-EXPOSURES.) In the instructions for developing you are told that old developer contains bromide which has been liberated from the plates which you previously developed; therefore, this old developer makes a splendid restrainer.

64. **Properly Exposed Plates Developing Slowly.**—As already stated, the first consideration in developing is the temperature of your developer. If the developer is cold the plate will develop slowly and thin. If the developer is diluted too much it will develop very slowly. If your carbonate of soda is of poor quality, or if you have not the proper strength called for, the plate will develop slowly. You must, therefore, be careful in preparing your developer. See that your sodas are of good quality. The anhydrous or pure crystals should be used. Always buy the same brand either in bottles or in sealed packages. Another important factor is the temperature of your dark room. If it is extremely cold the action of the developer will be very slow.

65. **Plate Flashing Up Quickly and Darkening All Over at Once, Detail Very Dim.**—When a plate acts like this it is a certain sign that it is over-exposed, or the entire plate has been fogged (light struck) before or after exposure.

66. **Judging if Plate Is Under-Timed.**—If a plate is under-timed you will have trouble in getting it started in developing. When it finally does start, the highlights will build up contrasty, but very slowly, and the shadows will remain clear. In case of extreme under-exposure the shadows will be almost clear glass. There will be little or no detail.

67. **Judging if Plate Is Over-Timed.**—If a plate is over-timed the action of the developing will be very fast. The highlights will develop rapidly, but will be closely followed by the shadows. The shadows will fill with detail, then the entire plate will appear to fog over, as it were, and instead of gaining in strength will grow dim.

68. **Producing Proper Contrast.**—You can only get proper contrast by being careful and developing the plates according to their ex-

posure. If over-exposed, treat it as such or you will produce weak, flat negatives. If under-exposed and you do not treat it as such, you will produce negatives with too much contrast, strong highlights and no detail in the shadows.

69. **Proper Color.**— The proper color of the negative should be on the gray order with just a tinge of brown. With the proper exposure and developer prepared according to the instructions, this is the color you will produce. If the plate is over-exposed, necessitating prolonged development, the plate will become stained a slight yellow, which, however, is not objectionable, as it will add strength to the printing quality. A thin, yellow negative will give a stronger print than one which is a blue-gray, for if a plate is extremely gray, or blue-gray, it will produce prints with weak shadows and highlights; a very pretty negative to look at, but one that will not give a snappy, brilliant print. The printing from such a negative will be very quick, so quick that the surface of the print only is affected, and when the print is washed the strength is washed away, resulting in a weak, mealy picture.

70. **Judging Proper Strength.**— It is impossible to give any method by which one could judge absolutely the proper strength of development under all conditions. Only practice and close observation can teach you this. The difference in exposure, the lighting, etc., all have some bearing on the strength to which one should carry the development. One rule can be followed, however, and that is when the distinction between the highlights and shadows is as it appeared on the ground-glass, making due allowance for the fixing, then the plate is fully developed. There are many ways of judging density. A very convenient one is to hold the plate before the ruby light and place one finger close to the film and near the strongest highlight, and when you find the highest light is as dense as the finger, you can consider the plate of the proper strength. It is a good practice in developing, when in your judgment the plate is developed far enough, to try and impress upon your memory the density of the plate developed, and, after fixing, examine the plate in daylight by looking through it. If it is too dense or too thin, you must govern yourself accordingly in developing the next plate. With this practice you will soon be able to judge the proper strength of development under all conditions.

71. **Judging When Plate Is Fixed.**— A plate is generally considered fixed when all the white or creamy effect has disappeared from the back of the plate, but even then, it is safe to allow your plate to remain in the fixing bath ten minutes longer. A plate may appear fixed and yet not be thoroughly fixed. If your fixing bath is cool and not too old, you could allow your plate to remain in it for hours and the hypo would do no harm. There is practically no danger of over-fixing; however, if the hypo bath is old and warm it would be apt to reduce the plate and soften up the emulsion so badly that the image on the plate would

be destroyed, or the emulsion would slide off entirely; therefore, it is advisable to renew your hypo bath often.

72. **Discolored Hypo Bath.**— This need not alarm you, as the hypo bath is good as long as it will fix the plate in a reasonable length of time, say twenty minutes, and not stain. Always rinse your plate (both sides) before placing in the hypo; otherwise you will be carrying the developer into the hypo, and this, with the silver in the plate, will cause the discoloration of both plate and hypo.

73. **Mottled Negatives.**— Generally caused by allowing the plate to remain in the developer without agitating. This is more frequently caused in extremely slow development; as for instance, when you are using old developer. *Remedy:* Obvious.

74. **Finger Marks.**— Caused by carelessness in handling plate before developing. *Remedy:* Never allow the fingers to come in contact with the film side of the plate.

75. **Frilling.**— Caused by warm solutions, warm hypo, or warm wash waters. *Remedy:* Keep all solutions and wash waters cool. (See paragraph 57.) Dry your negatives in a cool, well ventilated room so that they will dry as quickly as possible. Dry the negatives at an open window, being careful that the sun does not strike the same. Dry with electric fan when possible.

76. **Uneven Development.**— Caused by not covering the entire plate when first pouring on the developer. Parts of the plate that do not come in contact with the developer will develop slower, and no matter how long you develop it will show uneven developing. Insufficient amount of solution will also cause uneven development.

77. **Blisters.**— Caused by warm wash waters, warm developer, warm hypo and washing too long. *Remedy:* Keep your solutions and wash waters cool, and do not wash longer than one-half hour in running water. You must also be careful and see that your carbonate of soda is not too strong. If stronger than the formula calls for, the film will soften very readily and you are apt to obtain blisters.

78. **Pin Holes and Spots.**— These are produced in so many different ways that it is impossible to enumerate and describe all of them. The best way to prevent them is to observe cleanliness in all operations. Your dark room, graduates, measures and trays which contain developing solutions should be kept clean. Your camera and plate holder dusted occasionally. The fixing solution should be filtered to free it from any sediment, and each plate must be carefully dusted before placing in the holder and before placing in the developer. The most common spots are small, round, or nearly transparent, with dark defined edges. These are caused by air-bubbles adhering to the surface of the plate when the developing solution is first flowed over it. The gelatine being hard and the bubbles preventing the alkalies from taking hold of the emulsion at once, is apt to leave these little air-bells. These bubbles can be removed by gently passing a tuft of absorbent cotton,

"WOODLAND MIST"

thoroughly saturated with developer, over the surface of the plate immediately after it is immersed in the developer.

79. **Round Transparent Spots.**—May be caused by a drop of bromide solution, or a drop of hypo solution falling on the plate either before the developer is flowed over or even during development. *Remedy:* Never add bromide to the developer while the plate is in the tray; either remove the plate from the tray and then add the bromide (mixing well), or pour your developer into a graduate and add the few drops of bromide in the graduate and then pour the developer back over the plate. Wash the hands carefully after being in hypo, thus avoid carrying any of the solution into the developer.

80. **Small Transparent Spots, Triangular in Shape and Irregular in Size.**—These are caused by particles of dust adhering to the gelatine surface of the plate at the time of exposure in the camera, or by dirt in your developer or hypo. *Remedy:* Filter all solutions, dust the camera and plate-holder and plate, and no spots of this kind will appear.

81. **Large Transparent Spots, Triangular in Form and Irregular in Size.**—These are generally caused by a scum which forms on the surface of old developer, and sometimes on new developer, if after it has been mixed it is left exposed for some time before using, in the developing tray, or an open vessel, such as a graduate. When the developer is then distributed this scum breaks up into small triangular particles, and it adheres to the surface of the plate, thus preventing the action of the developing solution. *Remedy:* Filter such developers immediately before using.

82. **Small Transparent Spots Resembling Little Particles of Lint and Dust.**—These are usually caused by brushing the surface of the plate hurriedly before placing in the holder. The gelatine film becomes electrified by the friction and attracts the dust and lint floating in the surrounding atmosphere. *Remedy:* Always dust carefully and slowly; do not press on with your brush too hard; dust only in one direction.

83. **Purple or Dark Opaque Spots, Regular in Size but Comet or Irregular in Shape.**—These are generally caused by small particles of dry pyro coming in contact with the plate either before or during development, or by adding dry pyrogallic acid to the developing solution just before or while developing. These little particles of undissolved pyro when coming in contact with the plate will cause opaque spots. *Remedy:* Never add dry pyro to your developer. Never weigh your pyro in your developing room, especially just before developing. Sediment in your hypo bath often causes opaque spots. Iron or rust in the water used will cause opaque spots. *Remedy:* Make a new bath. If the water contains iron or rust, the pyro attacks the rust and is immediately coated with it, and when this touches the film it will leave an opaque spot. *Remedy:* Filter water through two thicknesses of muslin, tying the muslin over the tap. These spots at times can be

removed by soaking the plate in water to which has been added a few drops of nitric acid, being careful not to use too much acid.

84. **Yellow Negatives.**— Negatives will some times turn yellow in the final washing. This is attributable to the water. If the yellow is produced by weak or decomposed sulphite, or decomposed pyro, it will show just as soon as the plate is fixed. In either case the negatives should be immersed in a clearing bath. (For formula, see Chapter X, on NEGATIVE REDUCING.)

85. **Thin Negatives.**— Thin negatives with transparent shadows are due to under-exposure and can seldom be improved by intensifying. (See Chapter IV, DEVELOPING UNDER-EXPOSURES). Thin negatives with foggy detail in shadows are usually the result of over-exposure. The negatives will be thin in the highlights and will make very unsatisfactory prints. Diluting developer with too much water will produce thin negatives. Under-developing will do the same. The results produced by these different causes are not the same, but the difference is very slight, so slight that it is not easily described. Negatives of this kind can be improved by intensifying. (See Chapter V, INTENSIFYING.)

86. **Dense Negatives.**— Such negatives are generally obtained by over-developing, allowing the plate to remain in the developer too long. *Remedy:* Soak in hypo for twenty minutes and then reduce. (See Chapter X, on NEGATIVE REDUCING.)

87. **Parallel Lines on Negatives.**— These are generally caused by too strong a fixing bath and bath not thoroughly stirred before using. These lines, however, generally occur when plates are fixed in a grooved box.

88. **Part of Plate Stained Yellow.**— Caused by plate not being entirely covered by the hypo.

89. **Spots and Streaks Almost Transparent on Plates after Drying.**— Caused by water spattering on the plate when dry, or nearly dry.

90. **Granular Negatives, Film Having a Grainy Appearance.**— Caused by using too much or too strong a solution of carbonate of soda. Rocking tray violently while developing. Extremely slow drying of plate.

91. **Negative Drying too Slowly.**— Caused by drying plates in too warm, too cold, very damp, or poorly ventilated room.

92. **Negatives Evenly Developed but Drying Unevenly.**— If the negatives when partly dry are removed to another room which is much colder, or warmer, or if parts not dry are forced dry by fanning, they will dry unevenly. The part last dried will be more dense than the first part.

93. **Negatives Full of Dirt and Scum when Dry.**— Caused by dirt in wash water. *Remedy:* Before placing the negatives in the rack to dry, wipe carefully with a tuft of absorbent cotton thoroughly saturated with water. Clean your washing box every day.

94. **Yellow Negatives, Even with Sodas of Proper Strength.**—Sometimes sulphite of soda when in solution, even though it tests the proper strength, loses its life by age and becomes worthless; that is, it does not have its color preserving quality. An indication of this would be if the plates were yellow and grainy; in such cases make up fresh sulphite. It is best to not use sulphite solution over a week or two weeks old; better make up a smaller quantity and renew more often.

## CHAPTER IV.

## DEVELOPING UNDER-EXPOSURES.

95. It is not the object of this instruction to encourage the under-timing of plates, but to provide the student with a means of treating plates which he finds, upon development, are under-timed. In order to produce the very best results from plates so exposed, they should be treated according to these instructions.

96. Upon reading the title of the instruction, the first question that is likely to arise in the reader's mind is how he is to know before development that the plate is under-exposed, and if he does know, why does he under-expose. Under ordinary circumstances one should aim to fully time all plates. However, there are occasions when one may find it necessary to slightly under-expose a plate in order to produce certain results which could not be obtained were you to give the plate a longer exposure. This is the case more frequently in landscape photography. It will sometimes occur, however, in making portraits; also when children, especially babies, are being photographed, and more frequently when using black backgrounds.

97. In landscape work, for instance, you may be attracted to a pretty view full of deep shadows and strong highlights, which make it impossible to expose for the detail in the shadows and not over-time the highlights. While you can overcome this by cutting the exposure in half, still the plate is under-timed in the deepest shadows and you will have to rely on the developing to overcome this and make a good negative, full of detail and with good half-tones.

98. There are also scenes which the inexperienced worker would consider absolutely impossible to photograph, owing to their peculiar surroundings, and it is just these circumstances that attract the eye and make such a view interesting. The most picturesque scenes are generally the most difficult to reproduce photographically. We will imagine, for instance, a small brook, or a creek, located in some deep ravine, with willows and brush overhanging the greater portion of the water, perhaps with large trees on either side. A stone or rustic culvert crosses the stream, and when the sun's rays fall upon the ripples of water as they roll over the little pebbles and rocks in the brook, they sparkle like diamonds. If one could reproduce, photographically, this creation of Nature the highest attainment of art-photography, as applied to landscape, would be reached. The picture is there; the secret lies in the excellence of the view point and the scientific manipulation of the plate during development. For such a *picture*, we must first decide upon the best view point from which to make it. Raise or lower the camera to retain the effect of the ripples in the stream. The most rapid plates must be used, and the speed of the shutter must be equal to the motion produced by the running water.

99. In the majority of cases a speed of $\frac{1}{25}$ second will be rapid enough, using an open lens. It is advisable to use an open lens, for a small opening would necessitate longer exposure, and stopping down also accents the shadows, makes them deeper and sharper. The aim, therefore, must be to admit of as long exposure as possible, and yet retain the principal point in the view, which in this case is the ripples. The edge of the brook over-shadowed with willows and shrubbery will be quite dark, and to secure detail in this portion of the view would ordinarily require perhaps a full second exposure.

100. The principal point of view in this picture (the running water) cannot be photographed with a time exposure. We must, therefore, make such an exposure as will produce the effect desired in this portion of the picture. As mentioned above, this will require a speed of about $\frac{1}{25}$ second with an open lens, to produce the desired effect. It is need-

less to state that such a view should be made at a time of day when the light is the very strongest in the shadows, for the illumination is weak underneath the willows and shrubbery even when the light is strongest. The sunlight which shines through the leaves is very small in quantity as compared with an open light, and it is simply a matter of utilizing this quantity of light to the best advantage.

101. **Under-Timing Portraiture.**—In portraiture the only real necessity for under-timing a plate is when photographing children, especially babies. Many times a very natural, pretty pose and cute expression of a child may be obtained if the exposure is made quickly, thereby slightly under-timing the plate. There are also times when you are apt to slightly under-time a plate, and not know it. The very best operators are likely to misjudge photographic color values and slightly under-time their regular work, Such plates must be treated and developed entirely different from properly exposed plates and the developing chemicals must be so manipulated as to give you the best results under the circumstances.

102. **Action of Carbonate of Soda.**—You may be led to believe, because carbonate of soda is termed the detail producing chemical, and is used in developing to open the pores of the film, and permit the pyro (or whatever developing agent you are using) to build up the detail, that you can under-expose to any extent you please, and the carbonate, if used in sufficient quantities, will supply all detail required. *Such is not the case.* No chemical will supply detail where there has not been sufficient exposure to produce it. However, by the proper manipulation during development you can obtain all the detail that the exposure has produced, but such exposures cannot be developed with normal developer. They must be specially treated as under-timed plates. To develop in the ordinary way with a normal developer would give very unsatisfactory results — strong highlights, deep shadows and no detail. By altering the developer according to the methods given in this instruction, you can retain every value that is possible from such exposures, and many times

save a plate, which if developed ordinarily would be worthless.

103. **Developing.**—We will first consider the developing of a plate in which you are certain the deepest shadows are under-exposed. We will suppose that the subject is a landscape study such as we have described. Having made the exposures, now follow the developing of the plate so as to produce the best results. The plate without question is considerably under-timed in the most dense shadows, for the shadow portion of the plate had so little illumination that the exposure given has hardly produced what little detail was visible to the eye. Therefore, it is necessary to open the pores of the film so that the required chemicals may be given every advantage to act.

104. **Chemical Action.**—Remember the effects of the different chemicals used when making up the developer. Pyro being your developing agent; carbonate of soda detail producing agent which opens the pores of the film so that the developing agent can act, thereby supplying detail; and sulphite of soda controls the color. Carbonate of soda alone is a strong alkali, and when used in connection with pyro without any color preserving chemical would give very harsh results and a yellow negative. Therefore, carbonate of soda must be combined with a color preserving chemical in order to retain control of the color of the plate.

105. In an under-exposure it is necessary to open the pores of the film as much as possible before admitting the developing agent (pyro) to act; therefore, place the plate in a very weak accelerating solution composed of carbonate and sulphite of soda, using them at the proportionate strength given in the formula for ordinary developing. Sulphite of soda, hydrometer test 70; carbonate of soda, hydrometer test, 40. Take of these stock solutions one ounce of carbonate, and one ounce of sulphite of soda, add sixteen ounces of water. Soak the plate in this solution, covering the tray so as to exclude all light and air. Allow the plate to remain in the solution for ten minutes, rocking it occasionally so that the accelerator will act evenly. While the plate is soaking prepare the de-

veloper as follows: (Regular formula for stock solutions will be found in Chapter II, DRY PLATE DEVELOPING).—Of the stock solutions take,

Pyro.....1 dram.
Carbonate of Soda (40 hydrometer test).....1 oz.
Sulphite of Soda (70 hydrometer test).....1 oz.

106. Add twenty ounces of water, and pour this developer in a tray. Place the plate in this tray, covering it to exclude all light and air, being careful that the plate is entirely covered with the solution, and occasionally rocking the tray to avoid streaks. Allow it to remain fifteen minutes, when upon examination you will find the plate has developed slowly, but not hard. Should the plate not be fully developed, prepare a new developer exactly like that in which the plates are developing, and proceed the same as before. Repeat this operation, renewing the developer every fifteen minutes until the plate is completely developed.

107. **Tank Development.**—Another very good way is to use tank development. This method requires a larger quantity of solution, but several plates may be developed in this tank at one time. Provide a deep galvanized iron, or better still, a deep rubber grooved box, a regular hypo fixing box—a new one of course—one that has not been used for any other purpose. Fill this tank half full with developer, then add water to within one inch of the top, and stir well. Then place the plate, or plates, in this tank, covering it to exclude all light, and allow plates to remain half-hour, when they should be completely developed. If, upon examination, they are not strong enough, allow them to remain in the tank until fully developed. Owing to the large bulk of solution the tank developer will last for hours without renewing. See Chapter XIX, TANK OR STAND DEVELOPMENT.

108. **Action of the Pyro.**—The very small quantity of pyro used in developing under-exposed plates gives the accelerator an even opportunity to thoroughly open the pores of the film. The highlights having been fully timed, or possibly a trifle over-exposed, will naturally develop soft on account of the small quantity of pyro used. If the regular

amount of pyro had been used in long development, these highlights would clog and become very dense. Having, however, used only a small quantity of pyro, this will allow for extremely slow development. Consequently, the plate, instead of developing hard and contrasty, will be clear in the shadows, soft in the highlights, and full of half-tones.

109. **Developing of Doubtful Exposures Which Prove to be Considerably Under-Exposed.**— Such plates should be started in normal developer, and as soon as the highlights appear, if you observe the shadows are holding back, with practically no detail, and the highlights are building up slowly but very strong, it is a certain indication that the plate is under-timed; so at once place the plate in a tray of plain water. Owing to the fact that the plates are partially developed they cannot be placed in the accelerator bath, as given in paragraph 105, for the accelerator alone after the developing agent has once been applied would be liable to cause a chemical fog — therefore the safest treatment is a plain water bath. Allow the plate to remain in the water for ten or fifteen minutes, covering the tray so as to exclude all light and air. While the plate is in the water prepare a new developer, weak in pyro. Take two drams of your pyro stock solution, add one ounce of sulphite of soda solution (hydrometer test 70), and one ounce of carbonate of soda solution (hydrometer test 40), and then add sixteen ounces of water. Remove the plate from the water, and complete the development in this bath.

110. If the shadows fail to come up and still lack detail, it is well to gently press the ball of the hand, or the tips of the fingers, on the portions that will not develop, permitting the heat from the hand to warm that part of the plate, thereby assisting in developing more rapidly. Breathing on these parts of the plate will also have the same effect.

111. **Developing Normal or Slightly Under-Timed Plates.**— Place your plate in normal developer. Just as soon as the highlights begin to appear, carefully examine the plate by holding it before the ruby lamp, and if you find that the shadows are developing slowly, with little or no detail

showing in them, the highlights building up contrasty but slowly, you will at once know that the plate is a trifle under-exposed. Transfer it to a tray of fresh water, and allow it to remain for ten or fifteen minutes. You will be surprised to see how much detail the plate will develop in plain water after it has been transferred from a developer, in which it has been developing for a short time. Allow the plate to remain in the plain water for a few minutes, and when you find that sufficient detail has been produced in the shadows, return it to the normal developer. If the plate was over-exposed instead of under-exposed, and should you leave it in the plain water too long, you would produce a flat negative, often times producing fog in the shadows. It is, therefore, necessary to closely watch the plate at all stages, whether in the water or developer, and be certain the plate is either under or over-exposed before you attempt to alter the developer.

112. We would advise in ordinary developing of white drapery, where there is red or black hair to contend with, that you remove the plate from the developer as soon as the image appears, and hold the plate under the tap, permitting the water to fall on the hair, or portions you desire to develop more quickly. A few moments of such treatment helps the general result considerably.

113. To produce softness in the white drapery itself, place the plate under the tap just as soon as the image first appears, allowing the water to fall on the portions which do not develop freely. This will many times improve the negative.

114. Of course a great deal depends upon the temperature of the water you are using, also the temperature of the developer. When developing under-exposures the water should never be colder than 65° to 70° Fahrenheit. In winter months the chill should be taken off the water for all exposures, whether under-timed or fully timed, and should be kept at about the same temperature as in the summer months. In cases of developing under-exposures, it is advisable to have the developer never below seventy in winter, and sixty-five in summer. Do not attempt to develop under-exposures in cold, dark rooms. Try to have the temperature of the dark room

at least sixty degrees. If the dark room is cold the developer soon becomes chilled, and the action is much slower and will retard the development of the deepest shadows.

115. In case of warm climates or extremely warm weather, when the developer being warm is liable to cause the film to soften and perhaps frill, it is advisable to use an acid hardening hypo bath, prepared as follows:

116. **Acid Fixing Bath :—**

| | | |
|---|---|---|
| (*A*) | Water | 100 ounces |
| | Hypo | 2 pounds |
| | Sulphite Soda (granular) | 2 ounces |
| (*B*) | Water | 32 ounces |
| | Chrome Alum | 2 ounces |
| | Sulphuric Acid—C. P | 2 drams |

| | | |
|---|---|---|
| If by Hydrometer test (*A*) | Hypo test 80° | 100 ounces |
| | Sulphite Soda Sol. test 60° | 16 ounces |
| If by Hydrometer test (*B*) | Chrome Alum test 20° | 32 ounces |
| | Sulphuric Acid C. P | 2 drams |

117. After the ingredients are thoroughly dissolved, pour *B* into *A* slowly, while stirring *A* rapidly. This bath remains clear and fixes clean, after long continued use, but should be replaced as soon as the fixing becomes slow, as the bath is then exhausted. Allow the negatives to remain in the fixing bath at least five minutes after the whiteness has disappeared. The longer the plates remain in the fixing bath the less washing will be required, and with the acid bath the film also becomes harder, and fifteen to twenty minutes washing is sufficient.

118. A smaller portion of the bath can be made up if one so desires, but as the larger bulk keeps better, and if one has considerable developing to do, it is better to make up the full amount. If only an occasional plate is to be developed each day, then one-fourth the formula is sufficient, or one may purchase the regular acid hypo put up in small packages, making sixteen and twenty-four ounce solutions. These stock acid hypo solutions can be obtained from any supply house.

119. **Practice Work.** — It is advisable to purposely under-time a few experimental plates under different conditions. The different methods suggested for the treatment of plates under-exposed should be tried one method at a time. The negatives of first experiments should be dried, and good solid proof prints made; the necessary data should be noted on back of proofs, including date, and stating whether first, second or third experiment. These proofs should then be filed for future reference, and further experiments made according to instructions, always being guided, of course, by results of former experiments. It will not require many tests of this kind before one becomes familiar with the appearance of plates in the developer of all exposures, and can judge instantly how much nursing they require to produce good negatives, and by instinct apply the proper method.

## DIFFICULTIES — DEVELOPING UNDER-EXPOSURES.

120. **Negative Drying with too Much Grain.** — This is apt to happen with plates that have developed slowly. Long, continuous soaking will soften the film, and cause it to raise from the plate, and when it dries it will dry with a grain to the film. Another cause is due to previous soaking in the carbonate and sulphite bath. This opens the pores to an excess. Plates treated thus should be washed in running water for no longer than fifteen minutes and dried quickly either by an electric fan or in a room where there is plenty of air circulating. A good plan is to dry them at an open window, as this will give a free circulation of air, but you must be careful that the sun does not shine on the negative while drying, as the heat of the sun is apt to dissolve the film.

121. **Yellow Negatives.** — Long soaking in the water; soaking in the accelerator with insufficient sulphite; poor carbonate or poor sulphite and prolonged development are apt to cause this yellowness. When the pores of the film have been opened to an extreme the pyro is

apt to stain. As a general thing in an under-timed plate this yellow tint, if only slight, will do no harm, but rather adds strength to the printing quality. You can remove this yellow by treating with clearing solution, given in the instruction on NEGATIVE REDUCING, Chapter X.

122. **Plate Developing Only Partly and Then Stopping.**— When the plates are badly under-exposed they will generally act in this manner. By adding a little more carbonate of soda, being careful, however, not to go to an extreme, the plate will continue to develop. When you find that the shadows are beginning to fog it is advisable not to attempt to develop any further, simply rinse and fix the plate. Applying a fresh developer diluted with four times the amount of water and allowing the plate to remain in this bath for fifteen to twenty minutes will bring out all the details possible to obtain with the exposure given.

123. **Shadows Lacking Detail.**—If the plate is very much under-exposed the shadows will lack detail, no matter how you treat them in the developer. You can improve them to some extent, however, by either breathing on these shadows during development — holding the negative close to the mouth — or laying the fingers on the shadows. This warmth of the breath or fingers will assist the developer in acting. You must be careful, however, not to lay the ball of the finger on too heavily, or it will injure the film. You can improve them considerable by the treatment given in paragraph 122.

124. **Plate Frilling.**— If the developer becomes too warm, which might be the case in a very warm, dark room, or from the continued placing of the warm fingers in the developer, the plate is apt to frill. The excessive use of strong alkali (carbonate of soda), is apt to make the plate soft and frill. Under-timed plates, or plates which develop slowly, should be handled as little as possible, for the long soaking of the film causes it to soften and is, therefore, very easily damaged. See that your hypo is fresh and cold. After the plate has been fixed, rinse for a few moments, and place in a weak alum solution — decant half an ounce saturated solution of alum in ten ounces of water. This will harden the plate and overcome any frilling. Be sure and use only the decanted solution, for alum crystals coming in contact with the film will produce a purple stain. After hardening, wash thoroughly before setting to dry.

125. **Little Blisters Forming on Plate.**— Blisters on the plate should be treated exactly as you would a frilling plate. These little blisters come from the same source that causes the plate to frill, and if placed in the alum hardening bath immediately after fixing, the blisters will be avoided. Should the blisters appear during fixing in the hypo, then use an acid-fixing bath.

126. **Negatives Fogging During Development.**— Extremely weak developer and excessively long development under the ruby light is apt to fog the plate; also an excessive use of carbonate and sulphite. To

overcome this difficulty extreme care must be exercised in regard to the ruby light, for by long development even the ruby light is apt to fog the plate. You must also be careful and prevent the air from affecting the developer, which deteriorates, and causes oxydization very rapidly. A good plan is to have a cover for the tray, being careful, however, to rock the tray occasionally during development.

127. **Negative Flat.**— This is generally caused by misjudging the plate in regard to exposure. If, for example, your plate was only slightly under-exposed there would be no strength to the highlights, and the result would be a flat plate. If you find the plate does not gain strength in the highlights, and appears flat, place the plate in normal developer. You may even find it necessary to add a little more of the developing agent (pyro). Over-exposures and under-development will also produce flat negatives. Such plates can be improved by intensifying. (See Chapter V, on INTENSIFYING.)

128. **Negatives Lack Strength and Snap.**— When you find that the plate refuses to build up any stronger in a weak developer, transfer it to the normal developer for a minute or two, or until you have produced the proper strength in the highlights.

MORNING LIGHTS AND SHADOWS

## CHAPTER V.

## GENERAL NEGATIVE INTENSIFYING.

129. The object of intensifying is to rectify the misjudgment of exposure and development.

Many times very weak negatives are condemned on account of their poor printing quality, they being thin, and printing flat, caused by insufficient developing, under-exposure, or other causes. Many dark room men judge their negatives by brilliancy, regardless of their printing quality. The most beautiful appearing negatives do not always yield the best prints. On the contrary, some apparently poor negatives have the qualities which are essential in producing the finest prints.

130. A thin negative, if stained brown or yellow, will have better printing quality than one which is blue; therefore, a tinge of brown color is the best. Always judge your negative for printing qualities alone. There are times when, through misjudgment, a plate is not developed far enough, being removed from the developer too soon, resulting in a thin negative with little contrast between the highlights and the shadows.

131. Generally, in landscape negatives of this kind, the sky portion being thin will print gray, and the shadows will be weak. In portraiture the highlights would be flat. Such negatives may have the proper color (brownish tint), which would be to their advantage, yet they lack the snap necessary to produce strong brilliant prints where all the proper shades from the highest lights to the deepest shadows will appear as the eye sees them, with good detail. The remedy for

such a negative is to intensify it, thereby strengthening the highlights and shadows.

132. In many cases this treatment of the negative improves its printing quality so much that one not knowing how the negative had been treated would declare that the prints made before and after intensifying were not from the same plate. Intensifying is simply increasing the opacity of a negative. There are many methods employed for this purpose, but two are chiefly used, both being distinct from each other in the action of the chemicals employed. We will describe both, but recommend the use of the first.

133. **Methods of Intensifying.**— The first is simply increasing the density by thickening the deposit of the metallic silver. The second is by substituting another metal for the silver, having a more opaque color, causing the negative to become less transparent.

We recommend the first method, as it is the most simple to apply, and there is less danger of staining and other failures.

134. **Kind of Negatives Which Can Be Successfully Intensified.**— All weak negatives cannot be successfully intensified, but all can be improved, in some cases, however, but slightly. The following are the kind of negatives which can be materially improved by intensifying: Negatives which are fully timed and under-developed; negatives which are slightly under-timed and under-developed, having some detail in the shadows but lack strength; negatives which were over-timed and under-developed, having plenty of detail, but no strength to the highlights.

135. **Intensifying Formula.**—

| | |
|---|---|
| Warm water | 12 ounces. |
| Bichloride of Mercury | ½ ounce. |

Label this bottle "Poison" Intensifying Solution No. 1.

136. **Dissolving the Mercury.**— The bichloride of mercury will dissolve very slowly, but by persistent shaking most of it will dissolve. If particles remain undissolved use only the clear solution, as one of these small particles coming in contact with the negative is apt to leave an opaque spot.

CLEARING SOLUTION NO. 2.

Sulphite of Soda, Hydrometer test 10 to 12 degrees. (Or if by weight)
Sulphite of Soda—Anhydrous..... ½ ounce.
Water..... 18 ounces.

The exact strength of clearing bath is not essential. Therefore, for convenience you may use your regular Sulphite Soda Stock Solution used for developing, and dilute it one-half by adding an equal amount of water.

137. **Preparing the Plate to Receive the Intensifier.**—To intensify proceed as follows: First, place your plate, or plates, in running water for at least ten minutes, soaking the film thoroughly so that the chemicals will effect all portions evenly when applied. Use a tray just large enough to hold your plate, one that has not been used for any other chemicals. While your plates are soaking in the water place three ounces of your intensifying stock solution in your graduate, being careful that your graduate is perfectly clean, as the least bit of alkali or pyro would spoil the bath, and render it useless. Add to this mercury four ounces of water. Mix this solution thoroughly before you pour it into your tray.

138. By this time your plates have become thoroughly saturated with water. Pour off the water, and pour on your intensifying solution. Keep the solution flowing over the plate by rocking the tray until the surface becomes perfectly white. Occasionally examine the plate by looking through it to the light. When the plate appears dense and the surface is quite white, and in your judgment the plate has been intensified far enough—taking into consideration that the plate will lose some of its density in the clearing bath—then rinse it carefully in clear water for a few moments, and place the plate in the tray containing sulphite of soda clearing solution. Rock the tray constantly, allowing the plate to remain in the sulphite until it has returned to its original color.

139. **Re-Intensifying.**—If you find after clearing that the plate does not contain the desired strength, repeat the operation, but before doing so wash carefully, thoroughly eliminating the sulphite of soda so that you will carry no sul-

pbite into the intensifying solution. This operation of intensifying can be repeated two or three times, and each time the negative will gain in strength. After the plate is sufficiently intensified and cleared, place in running water for not less than ten minutes, or until it is thoroughly washed, and then place in the rack to dry.

140. **When to Stop Action of Intensifier.**— The greatest difficulty in intensifying plates is to know when to stop. This can only be determined by careful observation, watching the plate carefully, examining the surface and color of density while the mercury is bleaching the plate, and carefully noting how much strength it is losing in the clearing bath. If the reader will observe, and make mental notes of the different results obtained, he will soon be able to judge by looking through the plate just how far to carry the intensifying. If the plate has not been carried far enough, as stated above, repeat the operation, paying close attention to its appearance in each condition, so that you may be able to judge your future results upon the first application.

## GENERAL PRECAUTIONS TO BE OBSERVED.

141. **Rocking Tray While Intensifying.**— The trays must be continually rocked while applying either solution in intensifying to obtain even strength. The mercury trays should never be used for any other purpose, as mercury causes no end of trouble when coming in contact with other chemicals. Therefore, in order to avoid this danger it is advisable never to use mercury trays for any other purpose than for intensifying negatives, except for soaking the negative in plain water previous to intensifying. If, for instance, a plate is developed in a tray which previously contained mercury, even after careful rinsing, should the least trace of mercury

remain in the tray, black streaks would be likely to appear over the entire plate.

142. **Plates Becoming Stained by Intensifying.**— All plates must be thoroughly washed and freed of hypo before attempting to intensify. Plates which are not freed of hypo and in this condition are intensified will become stained. Owing to the presence of hypo in the film the clearing bath will affect the plate unevenly, parts of it (and sometimes all of the plate) will remain white, and not return to its original color.

143. **Strengthening Plate Without Clearing.**—A plate which is considerably under-timed, and has the least detail in the shadows and is not hard—dense in the highlights—can be improved somewhat by simply staining with the mercury. Such plates soak in fresh cool water the same as usual, and then immerse in the mercury intensifying bath until it has gained all the color it will. Then, without clearing in the Sulphite of Soda Solution No. 2, place the plate in clear water and wash thoroughly, and set in the rack to dry. The plate will be a cream color, and it is this color more than anything else that will aid you in obtaining detail, or printing quality. The color slows the action of the light in the printing, and your prints will be more solid, and have more depth and roundness. It is very essential, however, that you thoroughly eliminate the mercury solution from the plate by carefully washing before drying. Otherwise, the least trace of mercury will effect your prints, especially where platinum paper is used.

144. **Avoid Printing From Plates Lacking Strength.** —Never allow a negative that is not snappy to be printed from. It is not necessary, however, that a plate be thick and dense in order to be snappy. On the contrary, it is just the opposite. A good printing plate is quite thin, with clear detail in the shadows, and the highlights crisp but not hard. There must be half-tones in the strongest highlights. Such a negative will yield good prints. The majority of thin negatives are a trifle under-developed, making highlights a little mushy, with lack of crispness and roundness. Such

plates should always be intensified (strengthened), and the highlights built up a trifle.

145. **Light to be Used While Intensifying.**—As white light will not affect the plate, this work can be performed in subdued daylight, where you can judge the proper strength more accurately.

146. **Mercury Solution Can be Used Repeatedly Without Renewing.**—The mercury, or in other words Solution No. 1, can be used repeatedly. The solution used, however, should not be placed back in the bottle of stock solution, but should be poured into a separate bottle, and labeled "Intensifier ready for use." Should this bath by constant use become weak and work slowly, add to it a little of the fresh stock solution, thereby keeping the bath always in good working order.

147. **Clearing Solution Can be Used Repeatedly Without Renewing.**—The clearing solution, or sulphite of soda, can be used a number of times, as long as it will clear the plate by changing the color from white to original color. Just as soon as the action becomes slow it is advisable to discard it, and make a fresh bath.

148. **Special Formula For Strengthening Negatives of Uncertain Fixing.**—Another formula which we recommend in case there is any doubt in your mind as to whether the negative has been properly washed and freed of hypo, is as follows:—

| | |
|---|---|
| Bichloride of Mercury | 60 grains |
| Water | 8 ounces |

149. Add to this 150 grains potassium iodide, or enough to nearly dissolve the red precipitate first formed. Next add 120 grains of hypo-sulphite of soda in crystals, or sixty grains granular. In this solution immerse your plate until sufficient density is obtained. Examine the plate by looking through it, just as you would when using the single bichloride of mercury intensifier.

150. **Fixing the Plate.**—After the plate has taken on as much strength as you desire, place it in a very weak hypo-sul-

phite of soda fixing bath, hydrometer test ten degrees, for about fifteen seconds, after which wash thoroughly, and set up to dry. The image on the negative will then consist of a double iodide of silver and mercury of a reddish brown color, with good printing qualities. This latter formula is only recommended where there is any doubt as to whether plates are thoroughly fixed. In order to avoid using the last mentioned bath, and to be certain that the silver is entirely removed from the plate, it is advisable, after developing, to always fix a plate at least fifteen minutes after the silver has disappeared; then if you thoroughly wash, plates so treated can be intensified with the first formula given, which is most simple.

151. **Removing Varnish From Plates to be Intensified.**—There are times when a negative has been varnished for retouching, or for preserving the surface, which you afterwards decide should have been intensified. To intensify such a plate it is first necessary to remove the varnish. This you can do by soaking the plate in wood alcohol, and then with a tuft of absorbent cotton which has been thoroughly saturated with the alcohol, gently rub off the varnish, after which the negative should be placed in clear water to soak for about twenty minutes, when it will be ready for intensifying.

152. **Removing Varnish With Turpentine.**— Another method of removing varnish or retouching fluid, as well as the lead, from a plate, is to apply turpentine with a tuft of cotton. After the varnish is all removed rub the plate dry with a little dry cotton, and then soak in clear water for twenty minutes, after which apply the mercury.

153. **Plates to Use For Experimenting.**— It is advisable, in preparing this instruction, to make use of some discarded, thin, weak negatives for your first experiments, and intensify according to the formula given. After you become familiar with the effect of the chemicals applied, you can then use a plate which you desire to save and improve for future printing, and apply the intensifier to this plate.

154. In preparing results of this instruction one should make good proof prints before and after intensifying, and all data pertaining to the method of intensifying the plate should

be recorded on the back of the proof, always dating each proof and numbering whether first, second or third experiment. These proofs should be filed in your proof file for future reference, as they will be your guide in future experiments.

## DIFFICULTIES IN INTENSIFYING.

155. **Negatives Appearing Oily.**— If the negative has not been sufficiently washed and there is hypo present in the negative, or if it was previously dried and then not soaked sufficiently in the water to soften up the film thoroughly, the negative will appear greasy. *Remedy:* If there is hypo present, intensify with the formula which contains hypo-sulphite of soda. If the plate has been dried a long time, soak longer in water before intensifying.

156. **Judging When Plate Is Carried Far Enough in Mercury.**— If the negative needs only a slight intensification, allow it to remain in the intensifier just long enough to whiten all over. If, after clearing, it is not strong enough repeat the operation. In time you will be able to judge by the appearance of the image on the surface, and by looking through the negative. The negative, as it grows white in the intensifying solution, apparently becomes a positive and, if a black rubber tray is used, it acts as a black backing, and with very little practice you will readily see the image gain in strength on the surface. By close observation and practice you will soon be able to judge very accurately.

157. **Negative Intensifying Unevenly.**— If there are spots which do not turn white, this is a certain sign that the plate was not thoroughly fixed, was not allowed to remain in the hypo long enough. The portions not fixed will not be affected by the mercury. In such cases, intensify with the formula which contains hypo-sulphite of soda, and is intended for intensifying plates which are not thoroughly washed.

158. **Negative Stained After Going Through Clearing Bath Sulphite of Soda Solution.**— This is a certain sign that the negative was not thoroughly washed after fixing. If the negative is stained evenly it will do no harm; on the contrary it will add strength to the printing quality of the negative.

159. **Negative Not Clearing in Clearing Solution.**— If the sulphite clearing bath has been properly prepared, and if good sulphite was used, the negative will usually return to its original color. Should it fail to do so, first test the bath and see that the sulphite of soda is full

strength. Use a fresh clearing bath. An over-worked clearing bath will work slowly. Often a weak solution of ammonia will act when the sulphite has failed.

160. **When to Use Ammonia Clearing Bath.**—On under-timed plates the increase in intensity is generally not very great, and as the plate loses some of its density in the sulphite of soda clearing bath, and as ammonia clearing does not reduce as much as sulphite, it is advisable to use ammonia for clearing on all plates that are under-timed, and need strengthening. Ten to twelve drops stronger ammonia in half-pint of water will clear the plate nicely, and may be used in the above cases.

161. **Shadows Remaining Weak After Intensifying.**— If your negative is badly under-timed it is impossible to produce any detail in the shadows by intensification. The best way is to simply bleach the negative with mercury. Do not place in the clearing bath (sulphite of soda), but after staining all you can, wash thoroughly and set up to dry. The stain, if not cleared up, will slow the printing and give you all the detail it is possible to obtain from such a negative, and more solid prints will result.

162. **Negative Intensifying in Streaks.**— If the plate is placed in the intensifying solution, and allowed to remain there without agitating, the intensification is apt to be streaky. *Remedy:* Always rock the tray both when intensifying and clearing.

163. **Small Opaque Spots Irregular in Shape and Size.**— Opaque spots are generally caused by undissolved particles of bichloride of mercury coming in contact with the surface of the negative. *Remedy:* Always use the decanted clear solution.

164. **Intensifier Will Not Work After Using a Few Times.**— If the intensifying solution refuses to work, it is because the mercury by constant use has become weak. *Remedy:* Strengthen by adding a trifle of fresh stock solution of bichloride of mercury, or if it still refuses to act, then the life of the mercury has become entirely exhausted, and you should make up a new bath.

165. **Intensifying Solution Becomes Milky.**— This is caused by some of the sulphite clearing solution getting into the bichloride of mercury solution. *Remedy:* Discard this solution. Make up a new one, and be careful to never allow the sulphite solution to come in contact with the mercury. If you place your fingers in the clearing bath (sulphite of soda), wash them thoroughly before placing in the intensifying solution.

166. **Appearance of Old Negatives Which Have Not Been Properly Fixed and Washed.**— If the negative is very old, and it contains hypo, there will appear a vapor-like scum on the surface. It is then best to assume that it has not been properly fixed or washed, and if such a neg-

ative is to be strengthened, intensify with intensifying solution which contains hyposulphite of soda.

167. **Removing Varnish.**—By carefully following the instructions given in the lesson, you should have no trouble in removing varnish. If the turpentine will not remove the varnish, try soaking the plate in alcohol. If when the plate has been soaked in wood alcohol, you find after rubbing with absorbent cotton that there still remains varnish, soak longer, use fresh alcohol, then wash for twenty minutes in running water, and you will find that all the varnish has been removed.

## ADDITIONAL INTENSIFYING FORMULAE.

### Mercury Bromide Intensifier.

| | |
|---|---|
| Bichloride of Mercury | 30 grs. |
| Bromide of Potassium | 30 grs. |
| Water (warm) | 6 ozs. |

Add one ounce of the above solution to 4 ounces of water; in other words, enough water to cover the plate being intensified.

When thoroughly bleached in this solution the negative may be blackened in the usual way, by placing in the sodium sulphite bath, testing about 40 hydrometer test.

### Monckhoven's Silver Intensifier.

Solution A.

| | |
|---|---|
| Bromide of Potassium | 60 grs. |
| Bichloride of Mercury | 60 grs. |
| Water | 6 ozs. |

Solution B.

| | |
|---|---|
| Cyanide of Potassium | 60 grs. |
| Nitrate of Silver | 60 grs. |
| Water | 6 ozs. |

The silver and cyanide are dissolved in separate lots of water (3 ozs. of water for each), and the former added to the latter until a permanent precipitate is produced. The mixture is allowed to stand in the sun for 15 minutes, and after filtering forms Solution B.

Place the negative in Solution A until it becomes white; then rinse and transfer it to Solution B to blacken. If the intensification has been carried too far, it may be reduced by treatment with a weak solution of hyposulphite of soda.

## CHAPTER VI.

## LOCAL INTENSIFYING.

168. The object of Local Intensifying is to strengthen only parts of the plate which are weak. There are cases where, if we strengthen only a portion of a negative and allow the rest to remain as it is, the printing quality of the negative will be greatly improved. There may be portions of a negative which are a trifle soft, which, if strengthened, will produce stronger highlights. Often in a landscape the sky and distant objects are strong, but the foreground, especially if there is much green foliage, is thin and prints black. This foreground should be strengthened by local intensification. As there is danger of the solution spreading beyond the parts you desire to strengthen, great care must be exercised in doing the work. The greatest difficulty lies in applying the intensifier only to the parts that you desire to improve, avoiding its spreading to the parts that are already strong enough.

169. **How to Proceed.**— Place the negative which you desire to intensify locally, in a tray of water, and allow to soak for about ten minutes, or until the film has become thoroughly saturated with water. While the plate is soaking prepare the intensifying solution :—

| | |
|---|---|
| Intensifying Stock Solution No. 1..... | 2 ounces |
| Water ..... | 4 ounces |

170. Place this intensifying solution into the tray that you have set aside to be used only for intensifying, and immerse

the negative for a moment. Do not wait until the plate has turned white. The object of this is to slightly stain the entire plate, so that when you are applying the intensifier locally there will be less danger of staining should it happen to spread. Should it spread slightly beyond the parts you wish to strengthen it will spread gradually, and do no harm. Still had you not previously immersed the entire negative, giving it only a slight stain, it would be very noticeable. After immersing the entire plate for a moment, and rinsing as already stated, set it up to drain for a few minutes. While the plate is draining, pour about one ounce of the intensifying solution into a small dish, or saucer, and add to this two ounces of water. Next dip the fine point of a small camel's-hair brush in the solution which you have poured into the saucer, or dish, and apply to the parts that you wish to intensify. Be careful to use only a little intensifier, and apply only on the parts to be strengthened. If it spreads, immediately rinse the plate under the tap, and try it again. Always touch the brush in the exact center of the part which you intend to intensify.

171. **Why a Weak Intensifying Solution is Used.**—You will note the intensifying solution for local intensifying is much weaker than the solution used when intensifying the entire plate. This is because with a weaker solution you have better control of the intensification, and there is, therefore, less danger of over-doing or intensifying parts of the negative which should not be strengthened. Too strong a solution will have a tendency to spread. A weak solution is easily controlled during the application, with little danger of injuring other parts of the plate.

172. After you have obtained the desired strength in the weak portion, rinse in clear water, and then re-immerse the entire plate in this weak intensifying solution. This final immersion is given for the same reason that you immerse the plate before the local application. However, at this time your plate has been materially strengthened locally, and if any of the solution has spread beyond the parts intended, it is apt to be noticeable unless the plate is again immersed for

a moment or two, just enough to nicely blend the local work to the remainder of the plate.

173. **Clearing the Plate.**—After this immersion, rinse the plate carefully for a minute and then immerse in the sulphite of soda clearing bath, until the entire plate has resumed its original color. Use the clearing bath given in instruction on INTENSIFYING, PART I. (See paragraph 136.) There is absolutely no excuse for a flat printing negative, for if by improper treatment in the developer or improper exposure the developed plate is flat and lacks snap and contrast, one can strengthen the highlights, lighten the shadows, supply catch lights to drapery, lighten the hair where it is too dark and build in detail in the dense shadows, etc. For landscape work the improvements are still more apparent, in fact, with proper care one can produce almost any result. You must work cautiously, however, as great care must be exercised when applying the mercury locally, or you may ruin the negative.

174. CAUTION:—Bear in mind that the plate must have been thoroughly washed and freed of the fixing salt (hyposulphite of soda) before you attempt any intensification. If, after the negative is dry, you find it is not strong enough, repeat the operation, and in this case you need not place the whole plate in the intensifier, but soak in clear water for ten minutes; after which apply the intensifying solution with the brush to the parts you desire strengthened, exactly as in your first operation. When you have the proper strength, clear the plate in the sulphite solution, and then wash thoroughly and dry as usual.

175. **Locally Intensifying Negatives While Dry.**—Another method which is very practical, and which one should experiment with, is intensifying the negative while it is dry. To do this place on a piece of glass a few drops of the weakened mercury solution. To this add two or three drops of glycerine, and mix thoroughly. The glycerine will prevent the solution from spreading on the plate. Dip your brush in this solution, and apply carefully to the parts to be strengthened, always touching the center of the part first, and being careful

not to have too much of the solution in your brush. Allow this to remain on the parts until the desired strength has been gained. Then rinse and place in the sulphite of soda clearing solution, after which thoroughly wash and set up to dry.

176. **Plates to Use for Experimenting.**—For your experiments we would advise that you use discarded plates. After you have full control of the solution and can apply the liquid as you want it, without spreading, take up a good plate which you think can be improved by this treatment. Then proceed to carefully apply the solution where it is needed, working from the center, and blending gradually from the stronger highlights.

177. **When to Apply the Intensifier.**—As in reducing, the best time to apply the intensifier is immediately after the plate has been thoroughly fixed and washed. The gelatine film being swollen is most receptive and the intensifying is quickly done. Always be sure that the plate is perfectly washed after developing and fixing before intensifying, for if any trace of hypo is left on the plate it will cause a stain. The plate must also be thoroughly washed after intensifying.

178. In preparing results of this instruction, the same methods must be pursued as with the other instruction. Make good proof prints from each experiment, numbering them in regular order, and noting all data pertaining to the manipulation on the back of each proof, thus supplying valuable data for your future guidance.

## DIFFICULTIES — LOCAL INTENSIFYING.

179. **Parts not Improving by Intensifying.**—If the negative has been fixed in an acid hypo bath, or the plate was placed in a hardener, it will be almost impossible to intensify successfully. A plate of this kind should be thoroughly soaked in water for hours, and often you will find it necessary to strengthen the intensifying solution.

180. **Intensifier Spreading.**—To overcome this difficulty be very careful when applying the intensifier. As soon as there are signs of intensifier spreading, rinse and drain for a few minutes, and then apply

again, being careful to have only a little of the intensifying solution in the brush, and applying it exactly in the center of the part you wish to intensify. If it again spreads rinse at once, and repeat the operation. If this is not successful use the glycerine formula.

181. **Judging When Sufficiently Intensified.**— Only practice and close observation can teach you this. It is always safe to stop the intensifying a little before you think it is strong enough, and repeat the operation if you find the parts have not gained enough in strength.

182. **Intensified Portions Stained After Going Through Clearing Solution.**— If there is any hypo present in the plate it will always stain. If the clearing solution is not strong enough you will obtain a stain. If the plate originally was discolored a trifle, this stain will appear considerably stronger. Be sure and use fresh clearing solution, and see that your plates are thoroughly freed of hypo before attempting to intensify.

183. **Parts not Improved by Intensifying.**— A very badly underexposed plate can never be locally intensified successfully, as the shadows have nothing in them. The highlights should always take on a certain amount of density. If any part you wish to strengthen turns to a white or cream color, you can be sure that it is somewhat strengthened. In some cases you will find it best not to clear the plate after intensifying; allow it to remain this cream color, as the stain color will slow the printing, and assist in supplying strength and detail.

184. **Plate Refusing to Clear in Clearing Bath.**— See Difficulty, INTENSIFYING, PART I, paragraphs 159–160.

185. **Applying the Glycerine Intensifier to Dry Negative Without Effect.**— This is probably due to the plate being fixed in a hardening bath, or an acid hypo. Hold the plate flat, and apply the solution freely, and allow it to remain on the plate for a little while. It may take some time for the solution to take effect, and make any change.

186. **Glycerine Intensifier Spreading.**— To overcome this difficulty add a drop or two more of the glycerine, and be careful not to apply too much of the solution to the part of the plate which you intend to intensify.

Any other difficulties met with are very likely covered in PART I.— INTENSIFYING.

"AT PEACE"

Study No. 4, See Page 343 Dr. A. R. Benedict, Montclair, N. J.

## CHAPTER VII.

## DEVELOPING OVER-EXPOSURES.

187. The exposing of plates, or film, beyond the latitude in which they may be developed in a normally prepared developer, should be avoided wherever possible.

188. Until one becomes thoroughly trained in the required amount of exposure to be given they will occasionally misjudge the necessary exposure, and in the majority of cases such plates or film are over-timed. The object of this instruction is to correct these exposures in the development, and thereby produce good printing negatives, which, if developed, in the ordinary way, would be lost.

189. **Construction of Sensitive Emulsion.**— Before taking up the manipulation of over-exposed plates generally, we will consider of what the sensitive emulsion on a dry plate is composed, and how constructed. The emulsion of a dry plate is a mechanical mixture of some viscous substance, and sensitive salts of silver in extremely minute divisions. These minute particles of silver are held in suspension by the viscous substance, which may be either gelatine, collodion or albumen. For the dry plate, however, it is generally gelatine.

190. To more clearly explain why the silver salts are distributed in minute particles, and held in suspension in the emulsion, suppose we pour into a graduate a certain amount of water. To this we add a small quantity of common table salt, and then add a little nitrate of silver solution. The entire solution will immediately assume a milky appearance, because we have formed, when mixing these ingredients, silver chloride. This silver chloride will, in a very few minutes, fall to

the bottom of the graduate, and the clear solution of water may then be decanted. If, however, you substitute a warm solution of gelatine, or some gummy substance, in place of water, and then add the salt and nitrate of silver, you will obtain the same milky appearance, but the minute particles of sensitive silver salts will remain suspended. With these ingredients for the principal basis, a sensitive emulsion is formed which can very readily be flowed over a glass plate or film. When this emulsion is set and dried upon the glass it is then termed a Dry Plate, which is very sensitive to light.

191. When we place the dry plate in the plate holder, and attach it to the camera, it is ready for exposure. The slide being drawn, and the shutter opened, or the cap removed from the lens, thereby exposing the plate, the light admitted through the lens effects these minute particles of silver which are suspended in the gelatine. A certain amount of light is required to perform this work, and this amount of light you measure by the length of the exposure. If more than the necessary amount should be given, the plate will require treatment in the development of the image, to overcome the excess exposure given.

192. **Action of Light on Dry Plate as Compared to Printing-Out Paper.**— This action of the light on the dry plate is in some respects similar to that of sensitized printing-out paper. If you place a piece of printing-out paper on a negative, and place it in the sun, the light affects the parts of silver in the emulsion on the paper in the same way as on the dry plate, the only difference being that the emulsion on the paper is of necessity made less sensitive than the dry plate, because the emulsion used for sensitizing paper contains materials that cause the image to become visible as it prints. Therefore, you can see the image appear during the exposure on the paper, while it is invisible and does not show on the dry plate. The sensitive emulsion of a dry plate is also many times more sensitive than that of a printing-out paper; therefore, while practically the same action is taking place when the light comes in contact with either of the two, yet its action is much slower on the paper than on the plate.

193. If you were to continue printing sensitized paper beyond a certain stage, you would have over-printed; and the print would be too dark, and entirely worthless. This is exactly what happens to a dry plate when it is over-exposed. The plate, like the over-printed print, has become too dark, as it were, but unlike the print it is not lost, providing the proper measures are taken to cut off or remove some of the minute particulars of sensitive silver salts, which have been acted upon by the light.

194. **Restraining the Sensitive Emulsion.**—To illustrate: The sensitive emulsion on the plate is composed of layer upon layer of these minute sensitive silver particles. If you exposed the plate and gave two seconds' exposure and the correct exposure required but one second, it becomes necessary to cut off or make a number of these layers of minute silver particles unchangeable. Or, in other words, restrain them from developing so that when the developer comes in contact with them it will have no effect. This is generally done either by immersing the plate before developing, in a bromide of potassium solution, or, developing in old developer (developer that has previously been used), and which, of course, contains bromide; the bromide having been liberated from plates previously developed. For description of the action of bromide, see paragraph 35—DRY PLATE DEVELOPING.

195. **Why Plates are Over-Timed.**—The best photographers are apt to misjudge the strength of the light employed, sometimes due to the variance of the light at different times of day, or conditions of weather (cloudy or dark days), but more especially when they are in a hurry. While no two photographers will work alike, although they are aiming for the same effects, each has his one peculiar way of controlling and measuring the light employed in producing the desired result. Yet, there is one point upon which all agree, that is, that an over-timed plate, or film, is preferred to an under-timed one. The reason for this is that sufficient exposure is always required to supply detail to the shadows, and in an over-exposure we are always sure of the necessary detail even in the deepest shadows, while

in an under-exposure this detail is generally lost. It is much easier to rectify the exposure so as to retain the detail in an over-exposed plate than it is to obtain detail in a plate, or film, which has been under-exposed. The reason is that with an under-timed plate the exposure has been insufficient to supply the necessary detail, and even with the most careful handling in the developer sufficient detail cannot be produced, especially if the plate is very much under-timed. In some instances, however, if not badly under-exposed, fair results can be obtained in an under-timed plate, but the results are uncertain. With an over-exposed plate one can always regulate the developer so as to produce negatives with good printing qualities. It is for this reason that many plates are over-timed.

196. **Use of Old or Once Used Developer.**—In order that you may at all times be supplied with a restraining bath that may be applied to plates that are over-exposed, it is advisable to save the last normal developer used. It is a good practice also, after each developing in normal developer, to pour the solution used into a wide-mouthed bottle. The reason for using a wide-mouthed bottle is that it is much easier to decant the clear liquid from such a bottle. It is also much easier to pour the used developer into a large-mouthed bottle without the use of a funnel. In order to keep the developer free from dust, cover this bottle with a piece of glass, or cork it. This old developer having become charged with bromide liberated from the plates previously developed, will make a good restraining bath. This used developer will become somewhat discolored, but the very fact of its being discolored makes it all the better. This discoloration will prevent the light from the ruby lamp—even though slightly actinic—from affecting the plate while in the developer.

197. **The Use of Two Trays For Developing.**—In case of uncertain exposure, whether over or under-timed, and even for properly timed plates, a good method to adopt is to use two trays for developing. The reason for this is that should you find a plate over-exposed you can immediately transfer it to the tray which contains the old developer. Use one tray for normal developer, starting all plates in this. In

the other pour the old developer previously used, decanting clear solution. By clear solution we mean, not a solution that is clear in color, but simply clear of particles of dirt, or film, which might have come from the plates that were previously developed. Having placed the plate in a normal developer, watch it very closely and when the image begins to appear examine the plate and note the parts which should appear first. The parts which will naturally appear first will be the highlights, or the whitest parts of the image. Note if the shadows are holding their relative value to these highlights.

198. **Developing Different Brands of Plates.**—By relative value we mean the natural gradation from the highlights to the deepest shadows, taking, of course, into consideration that different brands of plates develop differently. For instance, with Cramer plates the entire image, both highlights and shadows, will appear, if not over-exposed, at about the same time; that is the highlights will be closely followed by the shadows. However, each light and shadow will appear in their proper tone and will grow stronger as the plate continues developing. When developing this brand of plate with correct exposure, you pay little attention to the shadows, so long as they remain clear, but develop entirely for the highlights in order to obtain their proper strength. When they are fully developed the shadows will also be developed.

199. In case, however, of over-exposure on Cramer plates, the shadows will flash up quickly, and be quite hazy. They will have a foggy appearance, there will be a lack of distinction between highlights and shadows. The entire plate will appear fogged, the amount of fog ranging according to the over-exposure. If only slightly over-timed, the fog visible will be only slight. If very much over-timed the fog will not appear greater but much earlier (quicker). In either case, place the plate immediately into the tray containing the old developer and allow it to remain there until the fog is checked and the plate is sufficiently restrained, always rocking the tray to keep the developer moving.

200. With almost all other brands of plates the highlights appear some little time before the shadows. Even if over-

timed, the highlights will appear first, then the middle tones and finally the shadows, but if over-timed the shadows will soon begin to fog over. As soon as they show signs of fog, indicating over-exposure, they should be restrained at once by placing them in the old developer. When developing any brand of plate bear this in mind, because, should the image flash up quickly, the shadows appearing at almost the same time as the highlights, you will know the plate is over-timed and you should immediately transfer it to the tray which contains old developer. If the plate seems quite hazy, indicating very much over-exposure, then add to the old developer, a few drops of ten per cent. solution of bromide of potassium, a stock solution which should be kept on hand at all times.

201. **Preparing a Ten per Cent. Solution of Bromide.**— To prepare this stock solution in a twelve-ounce bottle dissolve one ounce of bromide potassium in ten ounces of water, which, when dissolved, will give you practically a ten per cent. solution. The old developer, and additional bromide acting as a restrainer, checks the further development of the shadows, and permits the developing agent (pyro), to build the highlights to their proper density.

202. **Developing Extreme Over-Exposures.**— In case the plate is very much over-timed, it may require more dense developing than for normal exposure. This you can do by simply allowing the plate to remain in the developer longer than usual, even in the restraining bath. This prolonged development may be necessary in order to produce the desired contrast. No matter how strong a plate is developed, it is not carried or developed far enough unless the desired contrast between the highlights and shadows is visible, even if the plate does appear extremely dense.

203. When the desired contrast is reached, the plate may be fixed in the regular hypo bath. After fixing, the plate should show a fine contrast and a beautiful negative except that it is very hard and dense and would not produce a good print. Therefore before washing place this plate in your reducing tray and reduce it to the proper strength. (See Instruction on REDUCING.) After reducing, rinse off both sides

in plain water, return the plate to the hypo bath for a few minutes and then wash thoroughly and place in the rack to dry. In case the plate is so much over-exposed that it becomes fogged, even in the restrained developer, then carry it as far as possible in the developer so that the plate is quite dense throughout. Then fix, after which *reduce* very thin — thinner than you desire the finished negative. This will remove all fog. Wash well, after which intensify to the proper strength. (See Chapter V for INTENSIFYING.)

204. **Reducing Over-Developed Plates.**— You will notice by reference to the instruction on REDUCING that we recommend two different formulæ for reducing, one of which acts on the highlights almost entirely. This is the persulphate of ammonia reducer. (See paragraph 274.) The red prussiate bath, while it acts upon the highlights, also reduces the shadows. (See Chapter X on NEGATIVE REDUCING.) Before reducing an over-exposed plate which has been purposely over-developed, you must examine the plate thoroughly in order to determine which solution to use. If your plate is strong in the highlights only, and the shadows are clear and about the proper strength, you must use the solution that acts mostly on the highlights, which would be the persulphate of ammonia. On the other hand, if the plate is developed quite evenly and needs a general reducing in both highlights and shadows, use the red prussiate of potash. You will find a plate which has been extremely over-exposed and over-developed should always be reduced with the red prussiate of potash, for the reason that both the highlights and shadows are very much too strong and an equal reduction is required.

205. **Restraining the Plate too Quickly.**— CAUTION: When developing a plate and you find it over-timed, do not be in too big a hurry to place it in the restraining bath; allow it to develop until you have secured the necessary detail in these shadows. However, in a very much over-timed plate there is danger of waiting too long. You must, therefore, carefully watch the plate and just as soon as you find that instead of the detail in the shadows gaining strength

they are becoming flat — fogging over — at once place your plate in your restrainer. On the other hand, if you have not developed your detail before the plate has reached the restrainer you will have difficulty in obtaining it afterwards. Your restrainer prevents the shadows from building up and permits the highlights to strengthen while the shadows are being restrained, or, in other words, the shadows have stopped developing.

206. **Plate Developed Too Far Before Restraining.**— In case the development has been carried too far in the normal developer before restraining, and you have clogged the shadows, then it will require further development in the restraining bath. In other words, allow it to remain in the restraining bath considerable longer so as to build up the required contrast which must be obtained before the plate is fixed. A plate of this kind may appear extremely dense, so dense that it is almost impossible to see through it when holding it up to the light. This, however, must not alarm you because you cannot injure the plate no matter how dense it may be, as after fixing you reduce the entire plate to where you want it, and you will have obtained a negative of good printing quality.

207. **Treatment of a Plate Which You Know Before Developing to be Over-Timed.**— If you are aware in advance that a plate is over-timed, then in place of starting to develop it in normal developer start it in old developer first. If you have no old developer on hand, add a few drops of bromide solution to fresh developer. This will answer the same purpose.

208. Always have on hand a ten per cent. solution of bromide of potassium. Have it ready in case of over-exposure. A few drops added to the developer will add much to your restraining. If you have started a plate in normal developer, and you find it slightly over-timed, and needs restraining, do not add bromide while the plate is in the solution, but remove the plate, holding it under a tap of running water. While adding the bromide to your bath, rock the tray thoroughly, thus mixing the chemicals. Then

return the plate to the bath. This must be done rapidly, because even though your plate is removed from the bath it will keep on developing.

209. **Treatment of Plates Slightly Over-Exposed.**—In case the plate is slightly over-timed, and needs only a little restraining, we would advise using only half old and half new developer. The old developer will have sufficient bromide in it to restrain the shadows while developing until the high-lights are carried to their proper strength. Sometimes a plate that has been only slightly over-timed may be restrained too much, and the consequence would be that you would produce a contrasty negative with no detail in the shadows. As soon as a plate during development shows signs of too much contrast, immediately rinse in plain water, then place it in a normal developer, in which conclude the developing. This may also be the case with very much over-timed plates, where a too strong restrainer is used. If you find the plate building up with too much contrast, immediately rinse the plate in clear water, and transfer to normal bath.

210. **Practice Work.**—In preparing this instruction, you make two exposures of the same subject under the same conditions, over-exposing both. Develop one in normal developer, and the other treat according to instructions given in this instruction for over-timed plates. Dry the negatives, and make good proof prints. Carefully note on back of prints which method of developing was employed, and any data relating to the manipulation, such as time required for complete development, first appearance of image indicating over-exposure, how restrained. Each print must bear the exposure given; this is important.

## CHAPTER VIII.

## DIFFICULTIES—DEVELOPING OVER-EXPOSURES.

211. **Action of Developer on Over-Exposed Plates.**— A plate that is over-exposed will flash up quickly, as soon as the developer is flowed over it. The quicker an image appears or flashes up the more it is over-exposed. The image on a plate or film, normally exposed, should appear in not less than one-half minute, much depending upon the strength and temperature of the developing solution. Warm developer will develop more quickly than cold. Strong developer will also develop more rapidly than normal or weak developer. The entire outline of the image on a normally exposed plate will generally appear in from thirty to fifty seconds, and the image on the plate will gradually continue to grow, until the entire image is developed. The image flashing up in from five to eight seconds is over-exposed and must be restrained immediately, and the amount of restrainer must be judged by the rapidity of the appearance of the image. The quicker the image appears the stronger must be the restrainer. The following suggestions may be of service to those whose practical experience in the handling of over-exposures has been limited. These suggestions are based on the presumption that only pure chemicals are used in preparing the developer, and that they are mixed according to the formula and, of course, the plate must be started developing in normal developer.

212. *First.*— If the image appears in thirty to forty seconds, the exposure is normal and should be developed to completion in the normal developer.

213. *Second.*— If the entire image appears in eighteen to twenty seconds, the plate or film has been over-timed beyond the latitude for development in a normal bath, and the plate should be restrained at once, either by adding one-half old bath to the normal developer, or by transferring the plate to a tray containing old or once used developer, allowing it to remain in this bath for two minutes. If then it shows too much contrast, rinse it in clear water. Then return the plate to the tray of normal developer and conclude the development in this tray.

Should the plate or film after being two minutes in the old developer, appear flat and without contrast, then complete the development in the tray of old developer.

214. *Third.*— If the image appears in fifteen seconds, the plate or film is considerably over-timed, and about ten drops of a ten per cent. solution of bromide should be added to the old developer, and the plate transferred at once from the normal bath to the restraining bath. The tray must be agitated continually and the plate examined occasionally, and if the bath is not too much restrained, the development may be concluded in this bath.

215. *Fourth.*— Should the plate flash up in eight to ten seconds, the plate is very much over-timed, and should be placed in a bromide restraining bath, made up as follows: To three ounces of water add one and a half drams of ten per cent. solution of bromide. Immerse the plate in this bath for one minute. Then transfer to a tray containing old developer, and conclude the development in this bath. Should the plate, or film, show signs of over-restraining and develop too contrasty, then return the plate to the normal developer.

216. *Fifth.*— If the plate flashes up in from three to five seconds, or almost immediately after developer is flowed over it, the plate is greatly over-timed and should at once be placed in a tray of old developer and allowed to remain there while preparing a bromide bath of two ounces of a ten per cent. solution of bromide and four ounces of water. Transfer the plate immediately to this bath, allowing it to remain for two minutes. Then return to the tray of old developer for final development, and if necessary in order to obtain strength, finally finish the development in the normal bath.

217. **Developing Plates of Doubtful Exposure.**— There are times when one is obliged to make an exposure under circumstances which make it difficult to judge the exact exposure required. Under such conditions it is always advisable to make two exposures, one of which should be according to your judgment of the proper exposure; the other give a longer exposure, or, in other words, over-time it. Mark both slides, and make a memorandum of the exposure given, and when you come to developing, develop first the plate which in your judgment was the normal or proper exposure, starting it in normal developer. If it proves over-timed transfer it at once to the tray containing old developer. If it develops slowly, indicating under-exposure, add more water to the normal developer. The developing of this first plate gives you a key to the second plate. If the former was over-timed then you would start the second plate in old developer, and if the first was considerably over-timed, then you will need to restrain the second one considerably. You should then add to the old developer two drams of the ten per cent. solution of bromide. On the other hand, should the first plate prove under-timed slightly, the second plate should be developed in

normal developer. Under all circumstances, your first plate supplies you a key for the treatment of the second one.

218. **Judging During Development How Much the Plate Is Over-Exposed.**— It often occurs that the photographer, during the course of a day's work, makes a number of exposures, and, in his judgment, correctly times all of them. However, when he comes to developing his first plate he finds that he has erred in his judgment, and the plate is over-exposed, realizing that all plates exposed that day are over-timed. It is a question now as to how badly each plate is over-exposed and how to treat the remainder of the plates so as to produce good results. All will depend upon the first plate developed. This first plate is your key and will indicate how much over-exposed the remainder of the plates are.

219. If they are only slightly over-timed, it is advisable to develop them in the old normal developer from the start. You must bear in mind that this old, or once used normal developer, must not contain any other restraining properties. In other words, this developer has been used as prepared according to the formula and has not been altered in any way. If, for instance, bromide had been added to the normal developer, this would cause the old developer, when used on only slightly over-exposed plates, to develop too contrasty. Therefore, use old developer which was prepared normally and has developed one lot of plates only. Such a developer usually will restrain the plate sufficiently and good crisp negatives will result. However, if the first plate developed appears quite hazy, it may be well to add a few drops of a ten per cent. solution of bromide to the used normal developer. It is well, under such circumstances, to develop each plate separately until you arrive at a developer that is sufficiently restrained to produce good, crisp negatives from the start; then the remainder of the plates should be developed in a developer made accordingly.

220. After a little practice one will be able to judge by the appearance of the first plate developed exactly how much the others are over-timed, and will know exactly how much restraining is required.

221. **Obtaining Desired Contrast of Over-Timed Plates.**— When a plate is only slightly over-exposed, treat it according to paragraph 32, Instruction, Dry Plate Developing. If, however, it is badly over-exposed and you are developing according to instructions, and you cannot produce the desired contrast, it is because you did not allow the plate to remain in the restraining solution long enough before transferring to the normal developer. Or, if the plate was started in the normal developer, you may have allowed it to remain too long in this developer before checking or restraining. In either case if the plate shows flatness throughout the development, you must then over-develop to an extreme, and after fixing the over-developed plate then reduce it according to Instructions on Reducing Over-Developed Plates.

222. **Obtaining Clear Shadows.**— You can only retain clear shadows in developing, should the plate be over-exposed, by the proper

amount of restraining, either by the use of sufficient bromide, allowing the plate to remain in the bromide solution sufficiently long to properly restrain the shadows from developing before transferring the plate to the normal developer; or, by the use of old developer and the plate remaining in this old developer sufficiently long before transferring to the normal developer. The amount of restraining all depending on the amount the plate is over-timed. Bear in mind at all times that a plate that has been started in normal developer which proves to be over-timed will be fogged, and sort of a veil will appear over the shadows if the plate is allowed to remain too long in normal developer before restraining, no matter what restraining methods you use.

223. It is, therefore, evident that the first few moments the plate is in the developer are the most critical ones. It is during these moments that you must watch the progress of the plate, and the instant it shows signs of over-exposure the proper restraining must be done at once in order to retain clear shadows.

224. Again, you cannot expect to obtain clear shadows if your developing light (ruby light) is too strong. A light which would be perfectly safe, for correct exposures, may not be safe for over-exposures. The developing of an over-timed plate is slower than that of a properly exposed plate; consequently, the over-timed plate is exposed to the ruby light longer than a normally exposed plate, and, therefore, is subject to more or less fog from this light. It is well, under such conditions, to do your developing farther away from the ruby light so that only weak light falls upon the tray containing the plate and developer.

225. Sometimes high temperature in the developer or developing room, will cause foggy shadows. Constant placing of the warm fingers in the developer will warm the developer, and the solution exposed to the air for a long time is apt to become the same temperature as the dark room, and will, therefore, cause fog.

226. It is advisable when your plate is placed in a tray of restraining developer to place a cover over the tray, but do not neglect to rock the tray, because this is necessary to insure even development.

227. **How Far to Carry Development of Plates that Are Over-Exposed.**— The development of an over-exposed plate depends entirely on how badly a plate is over-timed, and how early the plate has been restrained in the development. It is far better to over-develop a plate, and after fixing, reduce it, than to under-develop. By over-developing an over-timed plate, you are aiming to build up your highlights. You realize that your shadows have sufficient strength, but the strength of the highlights are not sufficiently in advance of the shadows. Therefore, you carry the development farther to build up the highlights, knowing that the restrainer used in the development will, to a certain extent, hold back the shadows while the highlights are growing in strength. In other words, by over-developing you produce stronger highlights, and then by finally reducing with red prussiate of potash

(See Chapter X on REDUCING), you reduce the shadows equally, if anything, slightly more than the highlights and the result is a negative of proper contrast.

228. On the other hand, if you under-develop, you produce thin negatives with apparently plenty of detail but no contrast and no solidity, and absolutely no printing quality. Therefore, it is advisable until one becomes familiar with the proper developing of plates, under all conditions, to over rather than under-develop.

229. **Desired Amount of Bromide to Use.**— Bromide is used as a restrainer. The amount to use depends entirely upon how much the plate is over-exposed. By using a ten per cent. solution of bromide, the strength is such that a little more or less will do no harm; therefore, one can use bromide quite freely without any perceptible damage to the plates. After one becomes accustomed to restraining with bromide and after some experimenting with a few plates by first using, say, five or six drops, then if this is insufficient to restrain the plates properly, the next time try ten to fifteen drops. In this way one may soon be able to determine the necessary amount to use. The worker, therefore, should carefully note how much bromide he is using each time, and if the results prove that enough was used, or too much was used, govern himself accordingly the next time he develops an over-exposed plate.

230. **How Long a Plate Should Remain in the Bromide.**— Where plates are very much over-exposed, it is advisable to place them, previous to developing, in a bromide restraining bath, the strength of which depends upon how much in your judgment the plate is over-timed.

231. A fair rule to follow would be: If you consider a plate over-timed three times the normal exposure, then a bromide bath of, say, three ounces of water with one-half ounce of a ten per cent. solution of bromide added thereto, allowing the plate to remain in this bath for one minute, should be sufficient restraining. The plate should then be transferred immediately to a normal developer with one or two drops of bromide added thereto. The more the plate is over-timed the longer it should remain in the solution. If extremely over-timed then a stronger bromide solution should be used. Practice alone will teach you the exact amount of bromide to use, and the length of time the plate should remain in the restraining bath. Bear in mind that the immersing of the plate in a bromide solution previous to development is advisable only in cases of extreme over-exposure. Ordinary over-exposure can be restrained by developing in old developer, or by the addition of a few drops of bromide added to a normal developer.

232. **Yellow Negatives.**— Yellow negatives are generally caused from long development due to under or over-exposure. The developing of an under-exposed plate is always slow owing to the fact that a weak developer has been used, the emulsion on the plate is apt to become soft and this gives the pyro an opportunity to stain. The developing solution by the long development becomes discolored, therefore,

acts as a stain upon the film. This yellow stain, however, can be eliminated by immersing the plate or film in an alum solution. (See paragraph 270, Chapter X, NEGATIVE REDUCING, Part I.)

233. **Using Old Developer.**— When using old developer be sure and decant and filter the solution free of dirt or particles of film before use. The normal developer used for one developing should be your old developer for the next developing.

234. **Preserving Old Developer.**— For the preserving of old developer see paragraph 30, Chapter II, DRY PLATE DEVELOPING.

235. **Determining When to Check Development of a Plate Started in Normal Developer** — A plate should be transferred to the restraining bath — or in other words, the tray containing old developer — just as soon as you see the slightest signs of the shadows growing weak, fogging or veiling over. As stated before, the first few moments a plate is in the developer, it should be watched more carefully than at any other time. If you are developing several plates at a time, and one or more of them show signs of fogging in the shadows, transfer them at once to the old developer. Watch your plates closely and act quickly. Do not hesitate to transfer the plate to the tray of old developer if it shows the least sign of fog or flatness, for even should you be mistaken you cannot injure the plate by so doing.

236. **Clearing Stained Negatives.**— To remove the stain from negatives. (See Chapter X, NEGATIVE REDUCING.)

237. **Uneven Development.**— Uneven development — or plates with streaks in them — is generally caused by insufficient developing solution. It is also caused by not rocking the tray constantly during the development, or by allowing the plate to remain in the bromide solution, or in any restraining solution without agitating. A plate should never remain in any solution, no matter what it is, without being agitated and the solution kept constantly in motion. Too harsh rocking will give harsh, grainy effects. Rock gently sufficient to keep any sediment from settling on the plate.

238. **Mottled Negatives.**— This you can overcome by carefully rocking the tray during development. Sometimes this mottled appearance is visible on plates that have been reduced. This is caused by too strong a reducing solution, and not rocking the tray while the plate is reducing. Avoid too strong solutions of any kind.

239. **Large Transparent Spots.**— These spots are generally caused by adding bromide to the developer while the plates are in the tray. A drop of bromide falling upon a plate while developing, will restrain that portion of the plate which the bromide has penetrated, consequently, a round transparent spot will result. Streaks and spots will be the result if the plate were allowed to lie in the bromide solution without rocking the tray.

CAUTION.— Always rock or agitate all solutions while using them. Never allow a plate or film to remain in any solution without agitating.

SHEEP

Study No. 5, See Page 344

W. E. Bertling, Buffalo, N. Y.

## CHAPTER IX.

## ADVANCED DEVELOPMENT OF OVER-TIMED PLATES.

240. Most photographers have learned from experience that it is very essential to have sufficient time on all exposures. There are cases when in doubt as to the exact exposure necessary, and in order to be positive of the sufficient time, they expose a trifle longer than in their judgment they consider necessary, thus over-timing the plate.

241. Such a plate, if developed in normal developer to a finish, would be very dense, but flat. The prints from such plates would be anything but pleasing. With the proper manipulation, however, such plates can be made to yield very good prints. In fact, you can manipulate so as to overcome any reasonable amount of over-exposure, and thus save the negative.

242. Extreme over-exposure is not encouraged by any means; in fact, one should aim at the correct exposure at all times, for you cannot always produce as fine a quality plate by over-exposure as you can by correct exposure, no matter how much you doctor the plate. There are times, however, when plates are over-timed accidently, and these plates must be saved, and the very best possible results secured. To teach you how to do this is the purpose of this Instruction.

243. Over-exposing is more apt to occur in commercial photography than in portrait work. For instance, when making interiors, photographing machinery, furniture, stoves, draperies, etc., such work is usually photographed at the factory, and a large number of plates are exposed before return-

ing to the dark room to develop. As negatives made of all such objects must be fully timed you are apt to overtime. All negatives made under the same conditions are given practically the same exposure, therefore, if one plate is over-exposed all are. By developing one plate first you have a key to the rest, and can treat them accordingly.

244. Any reasonable amount of over-exposing can be overcome in the developing, provided you are aware that the plate is over-timed, and know pretty nearly how much, for then you can reduce the sensitometer back to that of a slower plate.

245. Note illustrations, Nos. 7 and 8. In No. 7 we have a plate with a two-second exposure, fully timed. No. 8 was given thirty seconds, or fourteen times more exposure than was necessary. In order to determine exactly how much the plate was over-timed, and to know how much the plate must be restrained, we developed plate No. 7 first. Finding this plate fully timed, we prepared to reduce the sensitometer of plate No. 8 before developing it, by placing in a bromide solution composed of: Water eight ounces, and ten per cent. bromide solution, two drams. We immersed the plate in this bath for four minutes, after which it was transferred to a normal developer with a few drops of bromide added. The results were as you see them in plate No. 8.

246. In all cases of extreme over-exposure, if you are aware that the plates are over-exposed, apply the above method. The longer the exposure, the more you must restrain the plate by immersing in a strong bromide bath.

247. When developing plates of unknown exposure, believing them to be over-exposed, always start either in old developer, or part old and part fresh. Or, if you have no old developer on hand, use normal developer with a few drops ten per cent. solution of bromide added. Place the plate in your normal developer, having a second tray containing a bromide bath made up as follows: To one-half-pint of water add two drams of a ten per cent. solution of bromide of potassium. As soon as the image appears on the plate, examine it, and if you find it flashing up quite quickly, as soon

Illustration No. 7
A Correct Exposure
See Paragraph No. 245

Illustration No. 8
Over-Exposure Corrected by
Proper Development
See Paragraph No. 245

as the shadows are developed, immediately place the plate in your second tray, containing bromide bath, and allow it to remain there for about four minutes, covering the tray to protect it from the light. The bromide at once acts upon the shadows, and restrains them from developing farther. After a few minutes, transfer the plate from the bromide solution to the normal developer.

248. You may find it necessary to make up a fresh normal developer to complete the developing. The strength of the bromide checking bath must be determined by the appearance of the plate when the image first appears. If the plate is only slightly over-timed, then dilute the bromide bath by adding double the amount of water.

249. Care must be taken when immersing the plate in bromide bath to be sure that the shadows are fully developed, for should you restrain the plate before all detail is developed, then your shadows will lack strength.

250. In cases of very slight over-exposure, we advise carrying the plate a little farther than usual in the normal developer, and then reduce the plate after fixing, with red prussiate of potash. (See Chapter X, REDUCING.) This solution will clear up the plate very nicely.

251. CAUTION:—If you had restrained the plate before securing full detail in shadows, when concluding the developing in normal developer, you would have found the shadows were developing very little, owing to the fact that the film was saturated with bromide. In order to secure further detail in the shadows you would have to soak the plate in plain water to eliminate bromide, and make a new developer weak in pyro, containing no bromide. That would give the detail-producing chemical (carbonate of soda) a better opportunity to penetrate the film, and open the pores. This method will require the developing of the entire plate farther than ordinarily. Finally reduce the whole plate to the proper density with red prussiate.

252. A few points must be remembered when developing plates that are over-timed. First,—it is the shadows that are over-timed and, therefore, they must be treated, and

not the highlights. Second,—you must judge as near as possible by the first appearance of the image on the plate how much it is over-timed, and then restrain the shadows accordingly. Sometimes to simply immerse the plate in a weak bromide solution for only an instant will sufficiently restrain the shadows to supply the desired results.

253. Should the highlights alone appear too strong after the plate is developed and fixed, apply the persulphate of ammonia reducer (See paragraph 274, Instruction REDUCING), as it acts on the highlights only. Immerse the plate in this bath, and when the desired reduction is obtained place the plate in the sulphite of soda bath, and finally wash and dry.

254. Should you know in advance that the plate is very much over-timed, then reduce the sensitometer by immersing the plate in a bromide solution before it is developed.

255. **Portrait Work, Over-Exposed.**— In slight over-exposure of portraits, start the plate in half old and half fresh developer. This many times will sufficiently restrain the shadows. If this is not enough, you can immerse quickly the plate for only a second in a weak bromide solution of one dram ten per cent. solution of bromide to one-half-pint water. The longer you allow the plate to remain in the bromide bath, the more it will restrain. If the plate is over-exposed only a little more than you can control with the half old and half new developer, immerse the plate for a second in the bromide bath. If the plate is considerably over-timed, then allow it to remain longer in the bromide. You must be guided entirely by the appearance of the plate when in the first developer, as to how much to restrain it. You can restrain as little or as much as you require by this method.

256. In order to become familiar with the advantages of these methods of developing, make two over-timed exposures. Develop one plate in the normal developer; the other develop according to instructions for over-exposures. Make proofs from both plates, noting on backs of same developer used, and any other data that will aid you in your future developing. Save these proofs, filing in your proof file for future reference.

## CHAPTER X.

## GENERAL NEGATIVE REDUCING.

NOTE.—In the following lesson wherever the word "plate" is used "film" may be substituted.

257. There are times when, because of faulty exposure, one finds it necessary to over-develop the plate, thereby producing, in case of over-exposure, a negative which is too dense. While by the over-developing the required values of the highlights and shadows have been retained, yet the plate will be so dense that the printing from it would be very slow and unsatisfactory. In the case of under-exposure, the shadows having been insufficiently timed to supply detail, the development is prolonged in order to obtain all the detail possible in the shadows; consequently the highlights are over-developed, and are too dense. The result is too much contrast, the negative having only highlights and shadows, but no half-tones, and no gradation from the highlights to the shadows. Necessarily, negatives of either the above classes are slow printers.

258. In order to improve the printing quality of such plates, it is necessary to reduce them. Many negatives that would be considered worthless, and are often discarded, may be remodeled and doctored up to produce excellent prints. In fact, in many cases the very finest prints are produced from negatives that have been doctored; not only reduced, but intensified, in order to produce the proper gradation from the highlights to the shadows.

259. **Reducing Over-Developed Plates.**— As all negatives that have been over-developed should be reduced in order to produce the best printing quality, we will, therefore, consider the action of the reducing agent, of which there are a number of different kinds, although the action of all are practically the same. If a plate was placed under a microscope of high power so that the action of the reducer on the silver granules could be observed, you would find that the reducer was dissolving, or removing these small silver granules of which the image on the plate is composed. The longer the solution remained upon the plate the more it would reduce, and if the reducing agents were allowed to remain on the negative long enough the entire image would disappear. As this reduction, however, can be checked at any time by immersing or washing the plate in water, one has but to judge when the plate is reduced sufficiently.

260. **Red Prussiate of Potash Reducer.**— There are quite a number of formulæ for reducing. There are also prepared preparations on the market. We will, however, consider the two which are most generally used, and which we recommend. The first is ferricyanide (red prussiate of potash). The reducer acts evenly on the entire plate, and therefore the thinner portions (the shadows), are liable to disappear before there is much change on the dense parts (the highlights). For this reason we recommend red prussiate reducer for over-exposed and over-developed plates, which are not only slow printers, but lack in contrast.

261. **Persulphate Ammonia Reducer.**— The second reducer which is very successfully used is the persulphate of ammonia. This reducing agent will first attack the denser portions of the negative, as they are more susceptible to the action of the reducer. The thinner portions of the negative (the shadows), are only slightly affected, therefore, for a plate which is under-exposed; or a contrasty lighting; or an over-developed, under-timed plate; we recommend the use of persulphate of ammonia. It will act upon these strong highlights first, and when the highlights are reduced to their

proper stage there will be proper gradation from the highlight to the shadows.

262. **Action of Reducers.**—The persulphate of ammonia not only reduces the size of the silver granules, but also alters the character of the deposit. The granules become opalescent, reflecting a milky or pearly light, resulting in the required soft tones in the negative. With the red prussiate (ferricyanide), however, the silver granules after becoming reduced remain opaque. The action of the red prussiate is also much quicker than that of the persulphate.

263. **Use Discarded Plates, or Films, for Experimenting.**—As the successful performance of this work depends on the proper mixing of the chemicals in the required proportions, we advise for the first experiments the use of old discarded negatives. When able to produce the desired results on these discarded plates, make use of these same rules and formulæ in your regular work, and apply one of the above reducers whenever you feel that you can improve the negative, or negatives. The expert has these reducing chemicals always ready at hand in the dark room, and when his practiced eye sees the occasion for their use, on account of under or over-timed exposures, he immediately applies them and, by correcting their faults, obtains good negatives.

264. **The Best Time to Reduce Plates or Film.**—The best time to doctor negatives that are to be reduced with red prussiate, is immediately after fixing, while the negative is wet and most receptive. In case you are to reduce plates that have already been dried, or for the benefit of practice you are to reduce old or discarded plates, it will be necessary for you to place the plate first in the regular hypo bath for at least thirty minutes, so as to give the gelatine an opportunity to become thoroughly saturated with the hypo. If the plate is not thoroughly saturated with the hypo before the red prussiate touches it, it will produce stain, and the reducing will also be slow and uneven. When reducing with persulphate of ammonia, however, it is different. The reducing with this chemical is best done

when the plate is dry. It will act more quickly, and the reducer will attack the highlights more readily.

REDUCING STOCK SOLUTION, NO. 1.

265. **Formula for Reducing with Red Prussiate.—**

| | |
|---|---|
| Red Prussiate of Potash (Ferricyanide).... | 2 ounces |
| Water ..... | 4 ounces |

You will find a little difficulty in dissolving all the crystals, but by constant shaking most of them will dissolve.

This Stock Solution must be kept in a well-stoppered bottle. A glass stoppered bottle is recommended. Wrap the bottle with black or yellow paper, and keep in a dark place, as strong daylight will affect this solution, and cause it to rapidly deteriorate. It is necessary that you observe the caution in regard to bottles for preserving your solution, and the manner in which it should be preserved. By doing this you will always be able to produce the best of results.

266. For use prepare as follows: To one ounce saturated solution hypo, add one-half-pint of water (eight ounces). Add to this about one dram of Stock Solution No. 1. To make a saturated solution of hypo, dissolve in a certain amount of water all of this chemical that the water can hold. When the chemical is dissolved in the water, the first portion added may disappear quickly enough, but as more is added, the dissolving proceeds more and more slowly until finally it ceases altogether, and some of the chemical failing to dissolve will sink to the bottom and remain there. The solution is then what is called saturated.

267. If upon applying the reducer to a plate you find that it does not reduce rapidly enough, add a little more of No. 1, and a proportionate amount of hypo, remembering that too little hypo will cause yellow negatives. Always bear in mind that the hypo is your color controlling chemical, and prevents the red prussiate from staining.

268. **Reducing the Plate.**—We will now suppose that you have your reducing solution prepared, and that you have

sufficient quantity. Never try to reduce with a small amount of solution, as the results will probably be uneven. Eight ounces of solution in a 5 x 7 tray is sufficient for a 4 x 5 or a 5 x 7 negative. Place your plate, or film, face up into the tray which contains the solution. Rock the tray gently, but never in one direction, as the negative will start reducing very quickly. Examine it frequently, and always rinse under the tap, or in clean water before examining. If you fail to rinse the plate it will keep on reducing while you are examining, and often times plates in this way are reduced too far. When it is finally reduced to the desired stage, where you have sufficient softness to the highlights, rinse it off under the tap for a few moments, and then place it back into the hypo for at least ten minutes. By placing back into the hypo the color of the plate is preserved.

269. **Plate Appearing Yellow.**—If the plate after reducing appears yellow, or at least a deeper color than you desire, you have not had sufficient hypo in the reducing bath. Sometimes the plate is yellow before reducing. In such cases you should not expect to change the color in this bath, as the reducing bath is not intended for clearing; in fact, it is more liable to increase the color. However, you may reduce the plate exactly the same as if you had the desired color, allowing for the changing of color. Then after fixing properly, and thoroughly washing the plate to eliminate all hypo, place it in the following clearing bath:—

270. **Clearing the Plate or Film.**—Dissolve four ounces of pulverized alum in one pint of water (sixteen oz.) Place this in a bottle, and label "Alum Stock Solution." Of this solution pour one-half-ounce into a tray, and add ten ozs. of water, and three drops of sulphuric acid C. P. Place your plate in the tray, and rock it freely. The color should disappear in a few minutes. If the bath works slowly, strengthen by adding more alum. When you secure the proper color remove the plate, and wash in plain running water for fifteen minutes, then place in the rack to dry. If you have no running water change the water on your plate about fifteen times. The sulphuric acid, even when combined with the alum, acts as a re-

ducer if used in excess quantities. Therefore, if not used cautiously it will reduce the strength of the plate, as well as clear it. If too strong an alum bath is used it will cause the film to pucker.

271. **Reducing Plates After They Are Dry.**—CAUTION:—Never try to reduce a plate until it is thoroughly fixed; to do so will produce a green color, and the plate is liable to reduce in spots. When reducing a plate that has been dried, it is a good plan to place it first in cool fresh water for a few minutes; then transfer the plate to the regular hypo bath, and allow it to remain about thirty minutes. Finally, without rinsing, place the plate in the reducing bath, rocking the tray gently. Never allow the solution to settle on the plate for a moment, or it will be streaked.

272. **Life of Reducing Solution, and How to Keep It.**—NOTE.—Red Prussiate of Potash, when mixed with hypo, decomposes very rapidly, and sometimes becomes worthless after immersing a half dozen plates. If more than this number are to be reduced, a new bath should be made up. The reducing should be done in the dark room by good, artificial light. A strong daylight is not advisable, as it affects the solution, and naturally shortens the life of the reducing chemicals.

273. **Judging Plates to be Reduced.**—By exercising judgment when to apply and use the reducer, you should never have a dense or slow printing negative. Frequently the true value of a negative is lost by slight over-development, and by training the eye to see this, and reducing the negative, it would be restored. This training is accomplished by close observation only, and by making mental notes. Try to impress on your memory the appearance of the plate before and after reducing, and in a very short time you will be able to judge just how far a plate should be reduced. You would then be able to judge correctly as to the printing quality, and development. If in doubt as to whether a plate would be improved by further reducing, allow it to dry, and make a proof print from it. If this proof prints slowly, and with too much harshness and contrast, again immerse the plate in the re-

ducer, and carry it to the proper stage. A plate that has once been reduced, and dried, will not reduce so rapidly the second time, even in a fresh reducing bath, and unless the solution is agitated carefully one may find the reducer to act in streaks. Therefore, avoid too strong a reducing for second immersion, and don't be annoyed if the reduction acts slowly, as the plate will be better for it.

## PERSULPHATE OF AMMONIA REDUCER.

274. **Reducing with Persulphate of Ammonia.**—The persulphate of ammonia does not keep well when made in solution, and, therefore, it should be made up in small quantities, mixed for immediate use. This chemical, which is a most valuable addition to the stock of photographic materials, is less known and made use of less at the present time than its virtue would warrant. This is probably due, in part, to the want of knowledge of its properties, and the conflicting results that have been obtained with the first experiments. This, too, explains the reason for the various recommendations as to the strength the persulphate should be used at, which has varied in many instances from one to ten per cent. With a uniform preparation, however, the variations of results will be little or none, even when taking into consideration the different requirements of the amateur and professional. The amateur with fewer negatives to attend to, thinks nothing of spending a half-hour on a negative that he values, but on the other hand, the professional, whose time is money, would scarcely like to spend more than five or ten minutes on any plate. If longer time were required he might be tempted to leave the negative for a few minutes to attend to some other work, and probably forget it, and the nega-

tive in consequence would be spoiled by reducing too far. As there is nothing gained by the use of a very weak reducing agent, we recommend a method that will, on an average, require ten minutes to complete the necessary doctoring.

275. **Persulphate Reducer Grows Stronger with Age.**—The persulphate of ammonia from the moment that it is made into solution decomposes, and gradually becomes more and more acid. A good commercial sample of persulphate has a slightly acid action to start with, and this acid action rapidly increases when the persulphate is made into solution. A freshly made ten-per-cent. solution from C. P. persulphate has but a slight acid action, and can safely be used. This same solution, however, at the end of a week has a very strong acid action. A one-per-cent. solution at the lapse of a week acts more quickly than a fresh ten-per-cent. solution. Hence, our reason for using a fresh ten-per-cent. solution, and for making up only sufficient quantity for the plate, or number of plates, to be reduced. If the solution is made up of ordinary tap water, which usually contains chloride of carbonate, the action of the chemicals is quickly seen by the gathering of a milkiness on the surface of a negative. This is not the case if distilled water were used. It is, therefore, advisable to use ordinary tap water, as it acts as a guide. If old solution is used the reduced negative will assume a sickly sepia tint, and while the strong parts apparently are reduced, yet the color of the plate is such that the negative has not been improved for printing quality by the reduction.

276. From the above one will readily see that the persulphate is of uncertain action unless used fresh, and it is for this reason that we wish to impress on the worker's mind the necessity of using a fresh solution for each lot of plates to be reduced.

277. **Persulphate Formula.**—Formula for Persulphate of Ammonia Reducer:

| | |
|---|---|
| Persulphate of Ammonia Crystals..... | 50 grains. |
| Water..... | 5 ounces. |

If a larger bulk of solution is required, add ten grains persulphate of ammonia for every ounce of water.

### REDUCING.

278. If a 5 x 7 plate is to be reduced, five ounces solution will be sufficient. If a number of plates are to be reduced, it is advisable to make up ten ounces of solution. This bath should be discarded as soon as you are through reducing, and if more plates are to be reduced later, a fresh bath should be prepared.

279. We will now suppose that you have placed your reducing solution in your tray. Take your negative without previously wetting, and place it in the solution. As we have said before, reducing with persulphate of ammonia is best accomplished when the plate is dry. The reducer will act with greater rapidity, and will attack the highlights more freely. Rock the tray gently. Examine the plate frequently, and when it is reduced to where you want it, you can stop the action of the reducer by first rinsing the plate in clear water, and then immersing it for about five minutes in a sulphite of soda solution, hydrometer test ten degrees. Or, dissolve one ounce of sulphite of soda in ten ounces of water. After soaking in this bath for a few minutes, wash in plain running water, and then place it in the rack to dry.

280. **Reducing Plates Hardened in Alum.**— The Persulphate Reducer will not act well upon plates that have been soaked, and hardened in alum. If you have plates which have been so treated, place them in plain water for ten minutes before applying the reducer. The soaking of the plates will soften the film, and open the pores, which have been closed by the action of the alum, the reducer will then act more freely.

281. **Traces of Hypo in Persulphate Bath.**— When using this reducer the negative must be freed from every trace of hypo. You are, therefore, cautioned upon the importance of using separate trays for different chemicals. If you have but one tray to use for reducing, you must see that it is thoroughly cleansed before using. For instance, should you have used the tray for reducing with red prussiate and hypo, and

only rinsed out the tray with plain water, sufficient hypo would still remain in the tray to contaminate the persulphate solution. In fact, the least trace of hypo would ruin a persulphate bath. Therefore, to insure good results, cleanse your tray thoroughly, and the best solution to use for cleansing the tray is one dram of sulphuric acid added to two ounces of water. Wash the tray thoroughly with this solution, and rinse with plain water. You may be sure that the hypo and other chemicals are then removed.

282. You are also cautioned when examining the plate which is being reduced, to rinse it off under the tap with plain water, before holding it up to the light, for if any of the solution remains upon the plate it is apt to run in streaks, and the reducing will continue, and thereby ruin the plate.

283. **Kind of Negatives to Reduce with Persulphate.**— Dense negatives resulting from over-exposure should not be treated in the persulphate ammonia bath, for in such a case you must reduce and clear the shadows as well as the highlights. The red prussiate of potash reducer is the best for such negatives. Dense negatives resulting from over-development of proper exposures, and from under-timed plates, that have been purposely over-developed in order to supply all the strength possible in the shadows, should be reduced in the persulphate ammonia bath. While the highlights alone are to be reduced, yet the entire plate is immersed in this bath, and the chemical action will be upon the highlights only. To apply a chemical that would act upon the shadows as well, would be ruinous; therefore, the persulphate should be used for reducing such plates.

284. In order to illustrate more clearly the advantage of the different reducing agents we present illustration No. 9 with only one-half of the plate treated with red prussiate reducer. If you will note this illustration No. 9, which was made from a negative that was over-exposed and over-developed, and then one-half of the plate reduced with red prussiate of potash, you will note the half which was not reduced shows but little of the image, and the part that was reduced gives a good strong print with clear shadows, soft highlights,

Illustration No. 9
Print from Over-Exposed and Over-Developed Negative,
One-Half of which is Reduced
See Paragraph No. 284

Illustrations Nos. 10 and 11
Before and After Reducing
See Paragraph No. 284

and good detail in both shadows and highlights. The reduced portion was completely printed in about fifteen minutes, while it would require hours to completely print the unreduced half and even then it would not produce as good a print as if reduced. In illustration No. 10, you will find the results produced by reducing with persulphate of ammonia. Here the plate had no more strength than was required in the shadows, but the highlights were too dense. The persulphate has acted upon these highlights alone, with the results as shown in illustration No. 11.

## NATURE OF CHEMICALS USED FOR REDUCING NEGATIVES.

285. **Red Prussiate of Potash** (Ferricyanide).—Red prussiate crystals, when pulverized, become a yellow powder. Action, acid. Must be kept from the light and air as it will readily decompose. Dissolves slowly. Do not confuse with ferrocyanide, commonly called yellow prussiate of potash.

286. **Persulphate of Ammonia.**— White crystals or granular. Action, acid. Will decompose readily if allowed to remain in the air. Dissolves readily in water.

287. **Hypo-Sulphite.**— Commonly called hypo (thiosulphate of sodium). Put up in crystals and granular form. Colorless. Dissolves readily.

288. **Alum.**— White astringent mineral substance. Action, acid. Dissolves readily. Put up in crystals and pulverized form.

289. **Sulphite of Soda.**— Transparent crystals, also granular and dried, (anhydrous). Very soluble in water, two parts of crystal are equivalent to one part dried, (Anhydrous, or granular. Chemical action, neutral or slightly alkaline. Do not confuse sulphite with sulphate of soda.)

290. **Sulphuric Acid, C. P.**— Chemically pure. A colorless, oily liquid. Commercial sulphuric acid is yellow or

brown, and should never be used. CAUTION:—Never pour water into sulphuric acid, as this would be most liable to cause an explosion. Always pour the acid into the water. Coming in contact with the flesh it will burn. Do not confuse sulphuric acid with sulphurous acid.

MARINE

Study No. 6

S. I. Carpenter

## CHAPTER XI.

# LOCAL REDUCING.

### PLATES OR FILM.

291. Undoubtedly many negatives are made in which it is desirable that certain portions of the plate be made a trifle thinner, yet it would not do to sacrifice the whole plate for a few minor improvements. By careful application of the reducing solutions, whether it be the red prussiate or persulphate of ammonia, the portions of the plate which print too harsh can be subdued.

292. **Class of Negatives that Can Be Improved by Doctoring.**— In landscape, cloud effects, and interior work, this doctoring is invaluable, for in this way all halation and objectionable highlights can be subdued, or entirely eliminated. In portraiture, for instance, where you have a red or tan faced subject gowned in white, there is apt to be great contrast, unless care has been taken in the lighting; even then, one when developing, in their endeavor to build up the face as strong as possible so it will not print black, is very apt to over-develop the drapery. Then, again, a white bow in the hair, a blue ribbon, etc., may develop very strong, and give chalky results. It also happens very often that the plate is under-exposed, and in forcing the detail in the shadows, the highlights become too dense. All these objections can be removed, and the negative very much improved by local reduction.

293. **Doctoring White Drapery.**— Great care must be exercised, else you overdo, or spoil the plate; still these methods are successfully employed every day, and practice will make you perfect. Sometimes in large groups there may be but one or two subjects in white drapery, and the rest are all in dark; usually the white gown is developed a trifle stronger than you would like, and, consequently, the white drapery prints chalky, compared to the others. In such cases it is necessary that only these white draperies be reduced. By careful application of the reducing solution one can improve many faults in any negative, even with entire groups of subjects all gowned in white, such as bridal parties, graduating classes, or even single subjects dressed in white. Where the delicate trimming of lace, etc., is sometimes lost, and there is little or no detail in any part of the drapery, one can by careful application reduce the harshness and supply detail. Where the dress is arranged in folds one can accent the shadows more or less by applying the reducer to these parts.

294. In PART FIRST, of NEGATIVE REDUCING, we described, in paragraph 260, the class of plates that should be reduced with red prussiate of potash. In preparing this Instruction, reducing portions of the plate only where it will do no harm to reduce the shadows a trifle also, it is advisable to use the red prussiate, and your first experiments should be with such a negative. After soaking the negative in the hypo bath for ten minutes, apply with a soft camel's-hair brush the diluted solution of red prussiate of potash to all parts that need reducing.

295. **Strength of Solution to Use.**—The reducing solution must be used diluted, because the action of the solution begins on the surface of the film, and works its way through, and, if too strong, in all probability would dissolve away some of the shadow details before accomplishing the required reduction in the denser parts of the negative. Too strong a solution will also work too rapidly for even reducing, and one is almost sure to produce blotches and spots, instead of gradually blended results. Great care must be exercised lest you touch other parts of the negative, which do not require

reducing. A good plan is to pour into a saucer a small quantity of the reducing solution, made according to instructions (see paragraph 265, PART I), diluting the solution by adding an equal amount of water. Dip the brush into this solution, and squeeze out the overflow of the brush on the edge of the saucer so that there will be but a trifle remaining on the tip of the brush.

296. **Applying the Reducer with the Brush.**— Hold the plate to the light so that you can see through it. If possible, have the light lower than the plate so that you can hold the plate almost flat when applying the solution. Before applying the solution, however, mop the surplus water from the surface of the plate with a tuft of cotton, or with the ball of the hand. This will prevent the solution from spreading. When applying the reducer do not allow it to touch any other portion except the parts to be reduced, and allow the solution to remain on the plate only a few moments at a time. After each application rinse off with water, thereby avoiding the spread of the reducing solution, and the danger of reducing too fast. Examine the plates carefully after each application. After you have applied the weak diluted solution a number of times, and have not obtained the desired result, apply a stronger one, working very carefully. It is safer to work slowly, as your results in the end will be much better, and there will be less danger of reducing parts that should not have been reduced.

297. **Use Running Water to Check Reduction.**— Always have running water from the faucet flow over the plate as soon as the reduction is carried far enough. This necessarily requires very quick action on the part of the operator, or the solution will be left a second too long, and the reduction carried too far.

298. **Avoid Granular Surface by Returning the Plate to the Hypo Bath.**— After the parts are reduced to your satisfaction, rinse the plate for a moment under the faucet, and then replace in the hypo bath for ten minutes. This will insure a good color to the plate, and will produce a smooth surface instead of a granular effect, which would be the

result if the plate were not returned to the hypo bath after the red prussiate had been applied.

299. **Applying the Reducer with the Finger, or Tuft of Cotton.**— Another very good plan, especially where you are reducing white drapery, is to apply the solution with the finger, dipping it in the solution and rubbing the parts to be reduced. Here again it is necessary to guard against rubbing these portions too hard. You should have running water during the process, so that you can quickly place the plate under the faucet after each application. For very delicate work, however, we advise using a No. 2 camel's hair brush; for heavier work you can apply the solution with the fingers, or tuft of cotton. In this way you can reduce strong highlights on the face, hair and drapery, but you must be exceptionally careful when applying the solution to the face that you do not overdo the work. When using the finger rub lightly or heavily, as may be required, but always bear in mind that it will not do to rub too hard. The sense of the touch will aid you in judging the amount of the reducing you are doing, as the film not only becomes thinner to look through, but really reduces in thickness. The sense of touch serves as a very good guide to prevent you from overdoing the reduction, or injuring the film by hard rubbing.

300. There are times when one would like to blend the drapery from the strongest highlights to total black shadows. This can be accomplished very nicely by applying the solution very lightly to the strongest lights, and gradually heavier to the parts requiring more reduction. A tuft of cotton is best for this work, as the reducer must be spread more broadly. While the majority of the reduction is in the lower portion of the plate one must occasionally swab, very lightly, the upper portions, rubbing heavier as you approach the lower parts, so as to gradually blend them. This blending will require considerable practice to do the work nicely, but when one gets the knack of doing it any desired result can be obtained. If the parts you wish to reduce are very strong, and the reducer does not take hold properly, use a double strength solution. When using the double strength solution hold the plate per-

pendicular, and apply to the lower parts, first blending upward. The reducer will then run over the parts to be reduced the most, and by constantly swabbing with the cotton, streaks will be avoided.

301. **Reducing Plates After They Have Dried.**—When the plate is dry, and you wish to locally reduce it, it is necessary to first place the plate in plain cool water for ten minutes. This softens the film, and opens the pores. Then transfer to the regular hypo bath, and allow to remain for ten minutes more, so that the pores of the film being open allow the hypo to penetrate quickly, thereby avoiding stain and spots, as would be the case had all the film not been evenly saturated with hypo.

302. After the plate is sufficiently soaked in hypo, it is advisable to immerse the entire plate in a very weak solution of reducer for only a moment (just enough to slightly stain the film). Then rinse with plain water, and apply the solution locally, as you require. Finally, when you have doctored the plate to your entire satisfaction, again immerse the entire plate in the reducing solution for a moment, after which rinse off quickly. Then place it again in the hypo bath for ten minutes, and finally wash for fifteen minutes in running water. If the negative requires much doctoring, the reducer may slightly discolor the reduced portions. If this should occur after the plate is thoroughly washed immerse it in the clearing bath. (See paragraph 270 of PART I.)

303. **Reducing with Persulphate.**—While most local reducing can be accomplished with red prussiate bath, yet, some workers prefer the persulphate for certain class of plates. In treating with the persulphate reducer, PART I, of this Instruction, you were told that the persulphate has a tendency to reduce the highlights without effecting the shadows; therefore, this reducer should be used only on plates where the shadows are already thin enough. Prepare your persulphate of ammonia reducer according to instructions in paragraph 277, PART I. Remember that it is necessary when using this reducer that the negative be absolutely free from every

trace of hypo. The application of the solution is exactly the same as that of the red prussiate. After you have reduced portions of the plate as much as you desire, rinse the entire plate in water. Then place it in sulphite of soda bath (see paragraph 279, PART I), after which wash in plain running water, and place in rack to dry.

304. **Applying the Reducer to Films.**— The application of the local reducing solution applies to films as well as plates. Both are reduced exactly alike. When applying the red prussiate locally to film, in order to hold the film perfectly flat, lay it on a piece of plain glass which has previously been wet in cold water. The surplus water on the glass and film will hold the film perfectly flat, while you are applying the reducer. If the film is of the curling kind, it will not lay flat by the above method. With ordinary tacks fasten the four corners to either a card board, or a small pine board, which has previously been thoroughly soaked in clear water, and while wet tack on the film.

305. If the persulphate reducer is used, it should be applied to the film while dry. In event of the film curling, the board to which it is attached must be dry and not wet. As any results produced by persulphate can be obtained with the red prussiate and many more effects that cannot be produced by persulphate can be obtained with the red prussiate, which is easily prepared, and much simpler to manipulate than the persulphate, it is advisable to use red prussiate for all local reducing.

306. While the best time to reduce or doctor a negative with red prussiate is while it is wet, or as soon as possible after the plate is developed and fixed, yet it is advisable, for experimental purposes, to use old or discarded plates or films. These being dry must be treated according to instructions before reducing. After one has become experienced in the manipulating of the reducer locally, it should be applied on all negatives requiring local reduction immediately after the plate is developed, and thoroughly fixed.

## DIFFICULTIES — REDUCING.

### DIFFICULTIES MET WITH IN REDUCING WITH RED PRUSSIATE OF POTASH.

307. **Negative Reducing too Slowly.**— Plates or films which have been fixed in a bath containing alum, acid, or any hardening chemical, are apt to reduce slowly, and at times not at all. Plates which have been dried a long time will reduce slowly unless the film on the plate is thoroughly softened, and this is done by first placing in water for ten minutes and then transferring to the hypo bath for half an hour. It is also necessary at times to strengthen the reducing solution by adding reducing agent. If too much hypo bath was used the reducing agent would act slowly, as the hypo would overpower and weaken the reducing agent.

308. **Negatives Reducing too Quickly.**— If the reducing solution acts too quickly, it is because the reducing agent used is too strong. *Remedy:* Add more hypo solution.

309. **Negatives Will not Reduce.**— If the negatives will not reduce place in fresh water for one-half an hour, then into the regular fixing bath for another half-hour, and reduce with double strength reducing solution. Use twice the amount red prussiate solution to the regular amount of hypo.

310. **Reducing Shadows too Much.**— If the shadows in the negative are reducing too much you should use the persulphate of ammonia reducer. Only by careful manipulation, however, can you reduce the highlights alone with red prussiate reducer. Apply carefully to the parts of the negative which need reducing. Do not allow any of the reducing agent to touch the shadows.

311. **Negatives Stained a Reddish-Yellow After Reducing.**— If the plate, or film, is stained a reddish-yellow after reducing it is because the negative was not perfectly fixed before reducing. It was not allowed to remain in the hypo long enough to remove all the silver from the plate. If the reducer is applied before the silver is entirely eliminated it will cause a stain which is almost impossible to remove. However, the clearing bath (formula for which is given in paragraph 270, PART I, NEGATIVE REDUCING) will generally improve the color.

312. **Negatives Streaked After Reducing.**— If the negatives have a streaky appearance after reducing, it is because they were allowed to remain in the reducing solution without agitating — rocking the tray — or if the plate is not thoroughly fixed before reducing it is apt to reduce in streaks. *Remedy:* Always fix plates, or film, ten minutes after the silver, or white, has disappeared, and carefully rock the tray while the plate is being reduced.

When applying the reducing solution locally, unless great care is exercised the reducing agent is liable to run on the plate and this would cause streaks. *Remedy:* When applying locally place the plate flat in a horizontal position, allowing the solution to remain on the plate for only an instant at a time, and rinse under the tap after every application, and before examining.

313. **Negatives Yellow After Reducing.**— If the plate is yellow after reducing it may have been slightly yellow before reducing, and the reducing will make this yellow stain a trifle darker. If the reducing agent is too strong, or the hypo too weak, reducing is apt to stain the plate. Generally the alum clearing solution will remove this stain.

314. **Removing Yellow Stain from Negatives After Reducing.**— If you find that the clearing bath will not act readily, add a little more alum and sulphuric acid. Sometimes, however, one may have added too much acid to properly balance the bath. In such a case the addition of more alum only to the bath already prepared, will at once start the plate to clearing. Care must be exercised when adding more alum or acid. Too much alum will pucker the film, and too much acid will reduce the plate. Therefore, add only a little alum at a time, and only a drop or so of acid. Use only chemically pure acid, and ground alum.

315. **Surface of the Plate Puckering After Going through Clearing Solution.**— If the surface of the plate has a shriveled-up appearance, it is because the clearing solution contained too much alum, and the strong alum puckered the film. Very little can be done to remedy this. Sometimes soaking in a fairly strong solution of carbonate of soda, and then washing thoroughly, will bring the film back to its proper form.

316. **Negatives Reducing in Clearing Solution.**— If the negative continues to reduce in the clearing solution, it is because the clearing bath contained too much sulphuric acid. When you first place a plate in the clearing solution allow it to remain for a moment only, and then rinse it under the tap before examining. If you find that the clearing bath is reducing the plate add more water before you place the negative back in the solution.

## DIFFICULTIES MET WITH IN REDUCING WITH PERSULPHATE OF AMMONIA.

317. **Persulphate of Ammonia not Reducing.**— If the persulphate of ammonia bath is prepared properly, and is of good quality, it reduces. If it acts slowly strengthen by adding more persulphate. (See paragraph 277, PART I.)

318. **Persulphate of Ammonia Bath Reducing too Quickly.**— If the persulphate of ammonia reducer acts too quickly, it is because the solution is too strong. (See paragraph 275, PART I, NEGATIVE REDUCING.) Always make up the bath just before you are going to use it.

319. **Parts of the Negatives Reduced with Persulphate Stained.**— If parts of the negatives which have been reduced are stained, place the plates in the clearing bath composed of alum and sulphuric acid. Previous to this, however, the plates should have gone through the sulphite checking bath. Be sure that the negatives are properly fixed and washed, and there will be no stain after reducing.

320. **Plates Very Glossy After Reducing.**— All plates will appear rather glossy after reducing, and are, therefore, harder to retouch and etch. The cause of this glossy appearance is that the reducing solution acts on the top of the film, and actually cuts away a portion of this film. At the same time it acts as an astringent, and draws the little globules of gelatine together, thus causing the hard, shiny surface. This can be overcome to a certain extent by soaking the plate for a few minutes in a carbonate of soda bath, about sixty hydrometer test. This will open the pores, and there will be very little gloss.

321. **Confining Solution to Only the Parts to be Reduced.**—To avoid reducing other parts than those you desire reduced, mop the surplus water from the parts to be reduced. The solution will then attack the film quickly. Work carefully, applying only a little reducer, allowing it to remain on the parts to be reduced for only an instant at a time. Rinse after each application, and do not use too strong a solution. It is necessary that you act quickly. You must think and act at the same time. Practice, and practice only, will enable you to overcome this difficulty.

## CHAPTER XII.

## UNIVERSAL DEVELOPING.

322. In our previous Instruction on ORDINARY DEVELOPING we dealt principally with the use of necessary chemicals, and the manipulation of the different solutions in order to produce certain results. The formula for developing, given in this instruction, is intended for all classes of work, and should be universally employed for general portrait or commercial photography.

323. After numerous experiments with the formulæ and instructions given in former lessons, you should have a fair understanding of the use of the different chemicals employed, and the advantage of altering the quantities of chemicals in the different solutions, from time to time, to suit the plate you are developing. Further, you should be advanced sufficiently to appreciate the advantage of the formula given in this instruction for rapid development of all classes of exposure, with little or no change of the developer, and yet produce the very best of results.

324. The simplest formula that one can employ, and yet obtain good results is always the surest and best. By applying the formula given in this instruction to all your future general work you will produce very uniform negatives, and with the slight altering from time to time to suit local water conditions every obstacle can be overcome.

325. You should profit, of course, by your previous experience with ORDINARY DEVELOPING, and by applying the same method with the formula called for in this instruction superior results will be secured. This formula you will notice

is divided into four solutions, the principal object of which is to have your normal developing agent (pyro) ripen in solution before using. If you were to prepare a gold bath for toning prints and use it immediately, without permitting it to set and become thoroughly mixed with the water, thus ripening the bath, it would work harsh and bleach the highlights in the prints; whereas, by allowing the gold and alkali to mix gradually with the water, and become thoroughly ripened, the bath works more evenly and smoothly, producing greater roundness, and a much more delicate effect. As it is with the toning bath so it is with the developing solutions.

326. If your developing agent is mixed from a concentrated stock solution directly with the accelerators of a less strength and then still diluted with water and immediately used for developing, the strongest chemical will attack the sensitized plate first. In this case the strongest chemical being your developing agent (pyro), the highlights are attacked, and if the plate is fully-timed the plate has lost its roundness before the accelerators have been sufficiently mixed with the pyro to supply the required softness. Thus, many times, plates that are really properly exposed, develop as though they were over-timed, and the same is true of under-exposures. The strongest chemical (pyro), attacks the highlights, and clogs the shadows before the alkali, or accelerator, has an opportunity to soften and open the pores of the film sufficiently to permit the developing agent to build them up, and assist in supplying detail.

327. This obstacle is overcome by permitting the developing agent (pyro), as well as the accelerator, to ripen before using. This you do by preparing your developer in four solutions and reducing the concentrated pyro stock solution to the strength required, ready for use, which proportions are equal to those of the sulphite and carbonate to supply a properly balanced developer. Each solution being prepared for some time in advance, all are well ripened, ready for immediate use, without adding water to the developer until just before using. If water is added at all it affects all the three

chemicals alike, as all are diluted to their proper proportions, and are perfectly balanced.

### UNIVERSAL DEVELOPING FORMULA.

328. Prepare your developer as follows:—

STOCK SOLUTION, No. 1.

| | |
|---|---|
| Water | 6 ounces |
| Sulphuric Acid, C. P. | ½ dram |
| Pyro | 1 ounce |

NOTE.— If softer results are desired use water twelve ounces in place of six, the other stock solutions remaining as they are, as the object is to change the strength of the pyro only.

Mix these chemicals in the order given. Add the acid gradually to the water. Never add the water to the sulphuric acid. By adding the pyro last you avoid early discoloration of this stock solution.

329. The sulphuric acid, used in Stock Solution No. 1, will preserve the solution from discoloring, and it also has a tendency to retard the development, and will hold the shadows clear and free from fog — sulphuric acid contains a fraction over ninety-two per cent. pure acid and, therefore, must not be used in excess quantities. Nitric acid may be substituted, if one so desires, but as the latter contains only sixty-eight per cent. pure acid, one dram should be used in place of a half dram of the sulphuric. As nitric acid has less retarding qualities (being a weaker acid), it is recommended for slow developers. As this formula is for a rapid developer, we recommend sulphuric acid.

STOCK SOLUTION NO. 2.

330. Procure a thirty-six-ounce bottle. Into this pour two ounces of Solution No. 1, and add thirty-two ounces of water.

STOCK SOLUTION NO. 3.

Sulphite of Soda, 40 hydrometer test, or by weight,

| | |
|---|---|
| Sulphite of Soda (anhydrous) | 1 ounce |
| Water | 13 ounces |

STOCK SOLUTION NO. 4.

Carbonate of Soda, 20 Hydrometer test, or if by weight,
Carbonate of Soda (anhydrous)..... 1 ounce
Water..... 23 ounces

**If soda crystals are used you will require double the weight.**

331. Use only the very best of chemicals. We would recommend anhydrous sodas C. P., and advise hydrometer test in preference to weight. Prepare all stock solutions in the order given.

## DIRECTIONS FOR USING.

332. Take of Solution No. 2, four ounces; of Stock Solution No. 3, two ounces; of Stock Solution No. 4, two ounces, —making eight ounces of solution. Before using pour this combined solution back and forth from the graduate to a clean tray, to thoroughly mix all of the chemicals. After placing the plate in the tray, pour the solution over the plate, and be sure to cover the entire plate with one sweep, as the action of this developer is so rapid that unless all parts of the plate are covered with the first sweep, there will likely be streaks and lines in the completely developed negative.

333. When making an exposure, whether portrait, landscape, interior or exterior, you must at all times expose for the shadows; that is, you must give sufficient exposure to supply the required detail in the shadows, but when developing the plate you must develop for the highlights, making due allowance for fixing.

334. You will find with this developer the plate, if properly exposed, will develop quickly, and the image will grow gradually. The shadows will develop along with their proper relations to the highlights, and when the latter are developed to the point you desire, your shadows will be crisp and round, with plenty of detail.

335. The color of the plate is governed by the strength of the sulphite. Water is subject to several chemical changes during the year. Usually in the spring the water becomes

infected with more or less vegetable matter, and there are other times when the water becomes more alkali than usual. You will realize this when your plates, after washing, are of a more or less yellow color—there being more alkali in the developer than enough to balance the developer. If the plate becomes too yellow you should increase the strength of the sulphite; if the plate becomes too gray reduce the strength of the sulphite. Allow the carbonate of soda to remain 20 Hydrometer test always, and regulate the color entirely by increasing or reducing the strength of the sulphite.

336. For Seeds, Stanley and Standard plates use the developer according to this formula. For Hammer plates use three ounces of No. 2 (pyro) in place of four ounces, and add one ounce of water to the developer. For Cramer plates use five ounces of No. 2 (pyro), in place of four ounces, and add one ounce of water to the developer.

337. From the fact that Seeds plates are very heavily coated, they must be carried farther in the developer than other plates. The reason you use less pyro for Hammer plates is that they are thinner coated, and work with greater contrast, consequently, to obtain soft effects they do not need the same amount of pyro, nor as strong contrast in the lighting of the subject as the other brands which are thicker coated, in which the contrast must be built up. Pyro is a contrast producer in developing. The emulsion of Cramer plates is such that it requires a little more pyro to give the desired contrast on this brand of plate. By adjusting the developer, according to formula, and instructions given herein, you can obtain every quality that exists in any brand of plates.

### IMPORTANT NOTES.

338. With this developer, working as it does quite rapidly, care must be exercised that you do not over-develop. Examine the plate frequently. It is a good plan to provide yourself with a washing tank; fill it with water, and when you judge a plate very nearly developed, place it in the tank

of water, and allow it to remain for fifteen minutes. If you have other plates to develop, proceed and develop all you have, but place them all in the tank of water for a short while before transferring into the fixing bath. You will be surprised to discover how much the plate will develop in the water, and the developing will not be harsh, but soft, mellow and round. The half-tones will be full of detail—the shadows crisp and snappy.

339. In case of a plate lagging in the developer, indicating under-exposure, place it in the tank of water for ten minutes at a time, then return it to the developer for a while, and if it still appears weak, again return it to the tank of water. The temperature of the water should be about sixty-five degrees. Many times a considerably under-timed plate can be treated in this way, and a splendid negative made of it.

340. In case of over-exposure — the plate flashing up quite quickly — it is advisable to provide yourself with a tray of water containing several drops of bromide, and place the plate in this solution for five minutes. This will restrain the shadows, and when returned to the normal developer the plate will develop evenly and round up, becoming more crisp as it continues developing. In case the plate was very much over-timed, and not checked soon enough, then you will need to develop quite dense, and finally reduce with red prussiate reducer. For formula, see instruction on REDUCING. Negatives that are just a little dense, and perhaps a trifle hazy, can be greatly improved— the shadows cleared and strengthened — by immersing the negative, after thorough fixing, for a few minutes in a weak red prussiate of potash reducing solution.

341. Another pyro formula which may be used for exceedingly soft effects :—

STOCK SOLUTION NO. 1.

| | |
|---|---|
| Water | 16 ounces |
| Sulphuric Acid | 10 drops |
| Pyro | 1 ounce |

"SNOW LIGHTS"

### Stock Solution No. 2.

Sulphite Soda, 60 hydrometer test, or, if by weight,
Sulphite Soda (Anhydrous)..... 2 ounces
Water ..... 18 ounces

### Stock Solution No. 3.

Carbonate Soda, 50 hydrometer test, or, if by weight,
Carbonate Soda..... 2 ounces
Water ..... 18 ounces

For use take,

No. 1..... 1 ounce
No. 2..... 1 ounce
No. 3..... 1 ounce
Water ..... 16 ounces

The temperature of all solutions should be as near normal as possible, sixty-five to seventy degrees Fahr.

### ALUM HYPO BATH.

In warm weather, or warm climates, the following alum fixing bath may be used in place of the plain hypo and water :—

*A* Water ..... 96 ounces
Hypo..... 2 pounds

*B* Sulphite Soda (Anhydrous), 4 ounces, or, if in crystals, double the amount.
Powdered Alum ..... 6 ounces
Citric Acid..... 1 ounce
Water ..... 64 ounces

When both solutions are thoroughly dissolved, pour *B* into *A* slowly, while stirring rapidly.

## DIFFICULTIES — UNIVERSAL DEVELOPING.

342. **Developing Heavy Shadow Lightings.**— In developing shadow lightings, in portraits or views containing dense shadows requiring detail, you must strive for clearness of the shadows, and softness of the highlights. This is controlled before development by the amount of developing agent that you are using. If you find the highlights building up strong — becoming dense, practically no half-tones showing in them — reduce the strength of your developer by adding water. Oftentimes if the exposure is short, place your negative in a tray of fresh water. If the negative is very much under-timed prepare a new developer, using one-half the amount of the developing agent (pyro), the regular amount of carbonate and sulphite, and double the amount of water. Generally this formula for universal developing, if the lighting and exposure have been anywhere near correct, will develop properly without altering.

343. **Developer Discoloring After Having Been Prepared Only a Short Time.**— If the water you are using in your pyro stock solution is strongly alkali, it will cause your stock solution to discolor quickly, and it might be necessary to acidify the water, neutralizing it, before preparing this stock solution. This you can do by adding a few drops of sulphuric acid. But first test the water with blue and red litmus paper. If the water turns the red litmus paper blue, you will know that it is strongly alkali. If, however, it does not change the color of either litmus papers, you will know it is neutral. If the water does turn the red litmus paper blue, then you will need to acidify it by adding a drop at a time of sulphuric acid until it becomes neutral.

344. When you have neutralized the water, then add in addition the amount of acid given in the formula; finally add your pyro. Keep your pyro stock solution in a tightly corked bottle, if possible, a brown or yellow bottle, and store in a dark, cool place. When you are preparing for developing, first pour your pyro solution in the graduate, next add your sulphite, then your carbonate. All stock solutions should be shaken before using, especially the pyro stock solutions, (so as to keep the acid thoroughly mixed with the pyro.) If your stock solution does not discolor rapidly there is no necessity for neutralizing the water.

345. **Negatives Drying with a Coarse Grain.**— This is sometimes due to the carbonate of soda being too strong, or prolonged development, or if the negative is gray and grainy your sulphite is also too strong. Reduce the strength.

346. **Shadows Fogging During Development.**— This trouble is generally found in under-exposures where you had altered the developer by reducing the amount of pyro, thereby producing a developer too

strong in sodas, both sulphite and carbonate, more especially, however, carbonate. The latter if used in excess of a sufficient amount to nicely balance the developer is sure to fog the shadows. Extreme under-exposure requiring prolonged development is also apt to fog the shadows. In such cases immerse the entire plate after fixing in a weak red prussiate reducing solution. This will clear it.

347. **Negatives too Strong in Color — Yellow.**— Either your sulphite of soda solution has deteriorated by becoming old, or it is not strong enough. Sometimes sulphite of soda solution that has been made up for a considerable length of time, while it may test the same strength, has lost the chemical action necessary to prevent the pyro from staining the plate. Discard this sulphite, and make up a new solution. The amateur who only develops occasionally should make up small stock solutions. Both sodas should be kept in tightly corked bottles. Yellow color may be removed from negatives by immersing in alum clearing bath. See formula in Instruction on REDUCING.

348. **Testing Old Sulphite of Soda Solution.**—Place a small quantity of your pyro solution in your graduate; next add a small quantity of sulphite, then add the same quantity of carbonate. If your developer turns dark, and refuses to clear up, as it should if the sulphite was fresh, you may be certain that the sulphite is too old and deteriorated. In making this test, use the same proportions that you would in preparing your developer for developing.

349. **Negatives which Appeared Sufficiently Developed, Very Thin After Fixing.**— If your negative is of a scene with heavy shadows, or a portrait of Rembrandt Lighting, the negative should be thin, and while it may appear too thin you will find that it has sufficient strength for good printing quality. If the highlights of the negative are very thin it may be possible that you are under-developing; therefore, you must experiment. Carry the developing a trifle further, and then watch your resulting prints.

350. **Proper Detail in Shadows.**— While this is governed greatly by the lighting, the detail in the shadows is often lost in the developing, and in the improper preparation of the developer, or from not handling the negative correctly during development. If you find that the highlights are building up strong, it is possibly due to the fact that your lighting was contrasty, or you under-exposed the plate. It is, therefore, necessary that the strength of the developer should be reduced and this you can do by adding water to the developer, thus treating the plate as under-exposed.

351. **Plate Inclined to Develop Contrasty.**— This difficulty is generally caused by either contrasty lighting, or under-exposure. Treating the plate for under-exposure during development — weakening the developer — will enable you to produce softer highlights, and, therefore, at the same time build up the shadows, and produce less contrast.

352. **Securing Half-Tones in Highlights.**— If the lighting is con-

trasty, even though the plate is fully exposed, the highlights will develop up exactly as they are lighted, and you lose practically all the detail. This is not the fault of the developer, but of the lighting. Subdue your lighting. You can improve a contrasty lighting *in the developer* by reducing the strength of your developer — adding water. This will give the shadows a chance to build up, and at the same time prevent the highlights from becoming dense, and will enable you to produce detail and half-tones.

353. **Plate Developing Flat.**— In portraiture this is due to flat lighting, or over-exposure. If the plate develops up very flat and your subject was properly lighted, and the plate properly exposed, it is because you have diluted your developer. Use a normal, full strength developer. If your plate is over-exposed, treat as such in development, and you will overcome this flatness, and produce more contrast. (See Instruction, DEVELOPING OVER-EXPOSURES.)

354. **No Detail in Highlights.**— This is due either to contrasty lighting, or over-development. Watch your plate carefully during development, and make the changes necessary in the developer to control detail in highlights. If the plate is over-exposed, add bromide, or place the plate in old developer. If it is a contrasty lighting, plate exposed about right, reduce the strength of the developer, by adding water.

355. Oftentimes it is a good plan, in this case, to place the plate directly into a tray of fresh water, and allow it to remain five or ten minutes, and then return the plate to a developer which should be only about half as strong as the developer you had been using, and you can reduce the strength by adding water. If the lighting and exposure are correct, and the highlights clog up so that there is no detail, this will indicate that your developer is too strong. Immediately reduce it by doubling the quantity of water. One should always strive to have the lightings correct, and never depend on altering the lightings in the developing.

356. **Retaining Soft Detail in Shadow.**— In case of contrasty lightings developing hard, and you are unable to produce the desired softness by manipulation, you should over-develop and after thoroughly fixing the negative reduce the entire plate until the highlights appear sufficiently soft, with sufficient strength, however, to give snap and brilliancy. The after reducing will also apply to plates that were properly lighted, but over-developed. By being careful not to allow your highlights to build up too strong, you will produce soft detail in the shadows. Too strong a developer will produce strong highlights and transparent shadows. Dilute the developer in order to secure softness. Under-exposure would produce strong highlights, and deep shadows. Dilute the developer with water. Over-exposure would produce dense highlights and flat foggy shadows. Over-develop and reduce with red prussiate.

## CHAPTER XIII.

## SPECIAL PYRO DEVELOPING FOR COMMERCIAL PHOTOGRAPHY.

357. By employing the methods for developing given in this instruction, one can overcome many obstacles, and produce successful photographs which, with ordinary developing, would be impossible.

358. Exposures under conditions which would ordinarily be considered impossible, can be obtained, and good negatives produced by the method of special development. In PART I of this instruction we will treat with COMMERCIAL PHOTOGRAPHY entirely. When making general exterior views, how often do we see pictures of scenes where, under a high sun, foliage and mountain tops are drowned into harshness, or even flatness, without any attempt at preserving the atmospheric effects visible. The haze in the distance, which is most beautiful to the eye, is lost entirely in the picture. Why? Because no special effort has been made to retain it. The hills instead of showing feeling and care are hard as stone. The haze is mere fog without atmosphere. All the most beautiful effects that are true to nature can be preserved, and it is these effects that make the picture interesting, and it is the object of this instruction to teach you how to retain them in every exterior that is out of the ordinary, and beyond this means of preservation with ordinary developing.

359. In interior photography we find many instances where it would seem absolutely impossible to obtain satisfactory reproductions of the view as it appears to the human eye. For instance, photographing interiors of churches with windows glazed with pictured glass which adds so much to the appearance of the structure. There may be light walls with dark trimmings, old mission pews, or they may be to the other extreme, all finished in white enamel and white marble, which make them still more difficult to reproduce photographically.

360. The photographing of the beautiful stained windows in clear detail, and at the same time retaining all the values of the dark trimmings, furniture, etc., seems difficult. Usually with non-halation plates one can produce fair results, yet there is always something lacking. The picture has not the snap, for while the halation from the light entering through the windows has been fairly well overcome, yet the life is absent. It must be understood that the use of non-halation plates is by no means to be discouraged. They are of great assistance, but by this special development greatly improved results can be obtained. You will not only retain the benefit of the double coated non-halation values of the plate, but will aid the plate employed in preserving and registering more accurately the view as it normally appears.

361. The photographing of interiors of the home admitting windows into the view is really important in making the room appear cheerful. The lace curtains and decorations generally with the strong light entering through the window, naturally over-exposing these portions would, if treated in the ordinary way, produce nothing but a haze and mist. While by the special development you can retain every thread of the design and figure in drapery and curtain as well as a clear view of the sash and window-frame, and at the same time obtain clear detail with splendid atmosphere throughout the room.

362. In the photographing of shops, public halls, and in extreme cases the photographing of difficult objects such as machinery which is stationary and cannot be removed to a

Interior Made with a Non-Halation Plate, Ordinary Development

The Same Interior Made on an Ordinary Plate, with Special Development

Illustration No. 12
Example of Overcoming Halation in Interior Photography
See Paragraph No. 364

more favorable light; and where in many cases the only illumination obtained comes from the side or rear, the windows which admit this one source of light must be taken into the view. By the ordinary method of developing, even with especially prepared plates, the results under these conditions would be very unsatisfactory and the worker would almost consider it impossible to produce a good presentable picture of his object or view. By this special method of development all this is overcome.

363. It is a fact that any effect that is visible to the human eye can be retained in the picture by proper exposure and development.

364. Illustration No. 12 is a representation of such a view as one would be apt to believe impossible to secure without so much halation that the interest of the view would be lost. This picture becomes more interesting as an illustration in this instruction for the reason that it was made by one of our students after making a miserable failure of the same view by ordinary method of developing.

## METHOD OF DEVELOPMENT.

365. The entire success of this method of development lies in sufficient exposure, and as the latitude as to extreme exposure is so great we must strive only to give full time, as any reasonable amount of over-exposure can be treated in the development of the plate. In the wet plate days we had less difficulty with these obstacles than we have with the dry plate. Why? For the reason that the emulsion of a wet plate was not $\frac{1}{50}$ as sensitive to white light as an ordinary dry plate to-day; consequently, there was more latitude to the exposure.

366. Next to the wet plate we have the process plate, or the lantern slide plate, all of which are extremely slow plates. For the lantern slide we require the clearest plate possible. The lantern slide must be absolutely clear and free from fog—shadows must be transparent. With the extremely rapid plate this would be impossible to produce except where the

most accurate exposure is given, and even then the results are not as satisfactory nor uniform. While the extremely slow plate is superior for quality, yet for general commercial work the slow plate would be impracticable. In many instances quite rapid exposures are necessary to obtain certain results which could not be obtained with the slow plate, and therefore the most rapid plate must be employed and a means of producing the same results, as is possible with the slow plate, must be accomplished in the development.

367. As stated in the forepart of this instruction, the entire success of special development rests in the exposure. You must time for the most dense shadows, and time them fully; a little over-time will do them no harm, as the over-time can be cared for in the development. By timing for the most dense shadows with this development the highlights will care for themselves, for you treat them in the developer so as to preserve them.

368. A good guide for exposure would be as follows:—Where you would ordinarily give ten seconds, with this method give from thirty to forty seconds' exposure, etc. All the detail in the most dense shadows must be supplied by the exposure, the rest you obtain in the developing.

369. The slow process of developing, applied by this method, will, with a full-timed exposure on a fast plate give you the same excellent results as a long exposure would give you on a slow plate in which the action of light upon the plate is so slow that it does not fog the plate. With a slow plate developed in a normal developer all chemicals act equally, for there are no great differences to overcome, while in the fast plate there are enormous differences in the effect of light between the strongest highlights and the most dense shadows. In severe cases, by this method of timing fully the most dense shadows, the highlights would be extremely over timed; therefore, in order to give us a well-balanced negative, we must restrain the highlights during development, and hold them in check until the shadows are fully developed.

DEVELOPING FORMULA.

370. STOCK SOLUTION No. 1.

| | |
|---|---|
| Water | 24 ounces |
| Pyrogallic Acid | 1 ounce |
| Sulphuric Acid | 8 drops |

STOCK SOLUTION No. 2.

Sulphite Soda (hydrometer test 70).

STOCK SOLUTION No. 3.

Carbonate Soda (hydrometer test 40).

371. To develop take one ounce of No. 1, one ounce of No. 2, and ten to twelve drops (no more) of No. 3, and add twelve ounces of water.

372. Before beginning to develop let us consider again the nature and objects of each chemical used in developing. Stock Solution No. 1 is your pyro solution, or (developing agent) strength producing agent. Stock Solution No. 2, sulphite soda, is your color regulating chemical. Stock Solution No. 3, carbonate of soda, is your detail-producing chemical.

373. In ordinary developing if you desire more contrast you would increase your pyro, because pyro being your developing agent gives you strength, builds up your highlights. If your plate developed yellow in color, you would increase your sulphite of soda in order to retain the proper color. If your plate lacked detail, and developed too contrasty, you would add carbonate of soda, because it opens the pores of the film and permits the pyro to get to the shadows, and, therefore, is your detail-producing chemical. For this method of developing we have provided by prolonged exposure all the necessary detail, so all we require is to retain this detail and produce the proper strength. It is absolutely impossible to develop a plate without at least some alkali, or detail-producing chemical. It requires but a very small amount of carbonate of soda,

yet some of this chemical must be used, or the pyro will not attack, and the plate will not develop.

374. Ordinarily, we would desire to have the pores of the film open up as it were, by means of carbonate of soda, thus permitting the pyro to act and build up, and supply the strength necessary. In this case, however, we do not desire the pores to be open, as we are already supplied with the detail by the exposure; therefore, we use only a few drops of the detail-producing chemical, merely sufficient to allow the pyro to develop the plate. The development will be gradual, and the shadows and highlights will build up gradually in their proper proportions, the plate remaining clear and crisp throughout the development.

375. When first placing the plate in this solution, it may require some three or four minutes before the image will appear. If it does not appear by this time, add three to five drops more of the carbonate of soda, or Solution No. 3. These additional drops of alkali will start the plate developing quite freely. After a few more minutes add a few drops more of No. 3, and again from time to time, *if necessary*, until the plate is fully developed.

376. You must bear in mind that you have added so little of this solution that the pores of the film are not filled with the carbonate of soda, none of your lights or shadows are clogged or choked; your plate is clear throughout, and your developing has been deeper and more solid, and, therefore, is really developed farther than if it were developed in the ordinary way.

377. Should you find after developing for some time that the plate is apparently fully developed with good, clear detail in the shadows, yet lacking snap in the highest lights, and continuous developing does not seem to build them up, then pour off this solution and make up a normal developer according to regular formula for universal developer. (See paragraph 328.)

378. Immerse the plate in this normal developer for only a moment, examining very closely, for in the normal developer the plate will build up very rapidly. When you secure the

proper strength which should not require more than a minute or two at the most, rinse the plate in plain water, and finally fix in a plain hypo bath free from other chemicals.

379. As the developing of the plate by this method is quite slow, requiring fifteen to twenty-five minutes, avoid undue exposure to the ruby light, as you are apt to fog the plate by long development in too strong a light. It is advisable to cover the tray during development and only uncover when you wish to examine it. These precautions must be taken in order to insure perfect success With care and patience the most beautiful results can be obtained.

## CHAPTER XIV.

## SPECIAL DEVELOPING OF WHITE DRAPERY PORTRAIT NEGATIVES.

380. The object of this Instruction is to train you in the method of producing the most beautiful chemical effects; how to preserve the relative value of flesh and drapery; how to preserve every effect visible on the ground-glass and "get it in the negative." Any combination of colors can be photographed, and their different color-values preserved, and by this method of developing the most beautiful chemical effects may also be obtained in white or black drapery.

381. This method of developing is especially effective where there is black or red hair to contend with. The dry plate is more sensitive to white drapery than to the complexion or dark hair. When making the exposure, the white drapery attacks the plate first, the shadows in drapery next, and lastly flesh and hair. White drapery, therefore, photographs quicker than the flesh.

382. Many operators in their eagerness to save the drapery, under-time the face and hair, or they may time long enough for the flesh, hair and shadows, and entirely ruin the drapery by over-exposure and improper development. One rule must be positively adhered to in order to make a success of this method of developing: You must time for your most dense shadows and time them fully. The highlights will care for themselves, for you treat them in the developer so as to preserve them. You can improve subjects gowned in white drapery, in the lighting, by diffusing the strong lights, but never by under-timing the plate. Usually when the light

on the drapery is diffused sufficient to balance the light on the face, the drapery is flat and lacks snap.

383. Over-timed white drapery with ordinary developing of the plate will give you flat results also, but by following the instructions given you will not only preserve your drapery, but you will also retain the values of the flesh and hair. Portraits of brides, or subjects gowned in soft drapery, aged persons, men with heavy white beards, heavy wrinkles, etc., should be treated and developed with this special developer.

384. Exposures of nervous people, or infants, cannot be easily handled with this special development, for the reason that you must make quick exposures of such subjects to avoid their moving, and as you must at least double the ordinary exposure when applying this method, you would not be able to obtain sufficient exposure for successful development. The main secret of successful development by this method, and the most important consideration in order to produce the proper results, lies in the exposure.

385. You must give plenty of time, exposing long enough to obtain proper detail in the most dense shadows. The shadows being fully-timed will give you very soft effects when properly developed. A good way to judge the proper time is as follows: —

386. Where you would ordinarily expose four seconds, for this method of developing you should give at least six seconds, and if black backgrounds are used double the ordinary exposure, or eight seconds will be better. You must supply your detail by the exposure. The rest you obtain in developing. The slow process of developing, which is applied in this instruction, will, with a full exposure on a fast plate, give you the same excellent results as a long exposure would give you on a slow plate in which the action is so slow that a long exposure does not fog the plate. The emulsion of a slow plate has more the speed of a slow bromide paper on which the action of light is slow, and, therefore, long development does no harm. Such plates are too slow to use for portrait work, and are generally used on lantern slides, where the most delicate lights must be retained, and the different color-

Illustration No. 13
Special Development of White Drapery
See Paragraph No. 390

values carefully preserved, but the long exposure necessary is not objectionable for this kind of work.

387. Slow plates are also used extensively for copying, as they produce the best results, and of course quick exposures are not necessary. For portrait work, in order to retain expression and avoid moving of the subjects, a quicker exposure must be made. To accomplish this and retain the same relative color value that a slow plate would give, a faster plate is used, which will be fully exposed with half the time necessary for a slow plate, and when developed according to the special formula, will give practically the same results as the slow plate requiring a much longer exposure.

388. But even the fast plate must be timed fully, and for white drapery almost double the regular time must be given. With ordinary development this would be entirely too much and would produce a flat negative. But as you secure your detail in the exposure, you must time for the shadows, which must be as fully-timed as the highlights, and then treated with the special developer. For formula and method of developing see paragraph 370, which should be read very carefully, and thoroughly understood before applying.

389. In portraiture there are many obstacles that can be overcome by this method of development, that would be impossible with the ordinary method.

390. The slow process of development permits one to build up locally any parts that seem to lag in the developer. For instance, if the hair is of a very dark color, or the shadows in drapery a trifle heavy, or the detail in black feathers on a hat lag a trifle in the developing, by dipping the finger in a weak solution of carbonate of soda, and applying to the parts you wish built up, will cause them to develop more rapidly. The least amount of carbonate will attack the parts applied almost instantly; therefore the carbonate must be applied cautiously, and the solution must be diluted, but by proper manipulation any desired result can be obtained. After some little practice one will learn to appreciate the extraordinary value of this method for special work. See Illustration No. 13, of portrait developed by this method.

391. The principal four points to remember for the successful application of the special development are: —

392. *First.*— You must give full time to the most dense shadows. Try to over-time a trifle — it will do no harm — but to under-time will result in total failure, for if you underexpose, then you would need to open the pores of the film by applying more alkali, or carbonate of soda. As the alkali acts on the entire plate it forces the highlights, and this is what you want to avoid. By this method the highlights are checked by lack of alkali, and the shadows build up equally with the highlights; so remember and time fully.

393. *Second.*—You must use the normal amount of pyro, and the normal amount of sulphite of soda, thus holding these two chemicals perfectly balanced.

394. *Third.*—Use only enough of carbonate of soda to set the pyro and sulphite to action, usually ten drops is sufficient for this.

395. *Fourth.*— Use double the amount of water usually used in ordinary developing. The water aids in supplying the mellow, round and crisp effect in the negative. Do not hurry the development. This is not a commercial developer; you are after quality, and in order to obtain the very best quality you must use care, and do not expect the image to appear for at least two minutes. If it does not appear by this time, a few drops more of soda should be added. When adding more carbonate of soda, bear in mind that this alkali opens the pores of the film and permits the developing agent, pyro, to act, and as the pyro acts on the parts of the plate exposed the longest — which are the highlights — the more carbonate of soda used the quicker the plate will develop; and if too much is added the highlights are apt to become choked before the shadows have had time to build up and strengthen. Therefore, by using a very small amount of carbonate, and the regular amount of sulphite, which is a neutral soda, you restrain the highlights, and permit the pyro to attack the shadows equally with the highlights, and gradually build them up together. Should the shadows be insufficiently exposed you can

not force them, and the result would be a very poor negative; therefore, ample exposure is essential.

396. By following the above instructions to the letter you cannot fail to produce the most beautiful results that it is possible to obtain by any known method of manipulating the chemicals.

397. It may require several trials before one will be able to manipulate the developer, and obtain all the quality there is in the plate, but by patience and care, and a little practice, one will soon learn to produce in the negative every effect that is visible on the ground glass, even to the most minute detail. It is not advisable to use this method of developing for all purposes, but only for special work where it is convenient to apply it. For general commercial work we would recommend the Universal Developing.

## DIFFICULTIES—SPECIAL DEVELOPING.

398. **Development Slow. Image Over Five Minutes in Making Appearance.**— If the plate has been sufficiently timed the image should begin to appear within two minutes, even though an extremely small quantity of carbonate has been used. If the developer is too cold the image will be very slow in appearing. If the temperature is correct, add a few more drops of carbonate, and continue adding a few drops at a time until the image does make its appearance.

399. **Image Flashing Up at Once.**— This would happen if the plate was extremely over-exposed, and too much carbonate of soda had been used to begin with, and possibly the developer too warm. If the plate acts this way place it at once in a restraining bath, either old developer, or add five drops of bromide to your special developer. This should not occur, even if plate was considerably over-timed, provided you have not used too much carbonate of soda. Long exposure requires less carbonate, and the shorter exposure more.

400. **Obtaining Proper Strength.**— If the plate has been sufficiently exposed and you have added your carbonate of soda too rapidly, or using too strong a solution you will produce flatness, and no strength. On the other hand, if you do not add carbonate of soda often enough,

the plate will remain weak, and develop extremely slow. After you have produced all the detail in the drapery, and find that the highlights hold back, and do not build up strong enough, place the plate for a few seconds in a normal developer. In this way you will obtain the necessary strength to produce highlights.

401. **Plate Fogging.**— A plate extremely over-exposed, with too much carbonate of soda used, is apt to fog. As in this method the development is extremely slow, it is advisable to keep the plate as far away from the ruby light as possible. It is also a good plan to use a cover over your developing tray. Air coming in contact with the developer will cause oxidation, which is apt to produce a scum and foggy effect on the plate.

402. **Plate very Thin After Fixing.**— Possibly under-developed, or too much carbonate of soda has been used. It is generally caused by under-development. You should bear in mind, however, that these plates are expected to appear somewhat thin, although you will find that they will have more printing strength than their appearance would lead you to believe.

403. **No Detail in Shadows.**— This is generally caused by under-exposure, and then using too little carbonate.

404. **Highlights too Strong, Losing All Detail.**— This will occur if the plate has not been sufficiently exposed, and too much carbonate is used. It will also occur if the plate has been sufficiently exposed, but the carbonate added in too great quantities and too frequently during development. Usually not more than one-half ounce all told of carbonate is ample to fully develop any plate.

405. **Color of Plate too Gray.**— The color of the plate is, of course, governed entirely with your sulphite. On account of the small quantity of carbonate being used it may at times be necessary to reduce the strength of the sulphite; otherwise the plates are apt to be too gray. It is advisable to have a tinge of yellow in the negative. The weaker the sulphite the more color you will have, and *vice versa.*

406. **Plates Frilling.**— As this is slow development care should be taken that the developer is not too warm, and that the hands are not placed in the developing solution too often, as every time you place your hands in the developer you are increasing the temperature, as the hands are naturally warm. Always use fresh strong hypo bath, and have it cold. If you find that the plates still show frilling treat them to a weak solution of alum immediately after fixing, always being careful to rinse the plates in water before placing in the alum. They must then be thoroughly washed before you set them up to dry.

407. **How to Treat a Plate which Has Not Been Sufficiently Exposed, so as Not to Lose the Negative Entirely.**— When you find that the exposure is too short for this development simply rinse your plate in water and transfer to a normal developer. Oftentimes you will find

it necessary to treat the plate as ordinary under-exposed by soaking in water, and then finishing in a diluted developer.

408. **How to Treat a Plate which Has Been Sufficiently Exposed, but too Much Carbonate Had Been Added to the Developer.**— Immediately remove your plate from the developer, rinse it for a few moments, and then place in a restraining bath, or add about ten drops of ten per cent. solution of bromide to your special developer; in other words, treat as over-exposed — developing to an excess and reducing afterwards.

409. **Plates Developing in Streaks, Uneven Development.**— This is generally caused by allowing the plate to stand too long without agitating the developer. While it is not advisable to rock the tray too much, you should rock it occasionally.

410. **Transparent and Semi-Transparent Spots in the Negative.**— These are generally caused by air-bells gathering on the plate when the plate is first placed in the developer. A very good plan is to swab the surface of the negative with a piece of absorbent cotton which is thoroughly saturated with developer. This will remove all air-bells, and will also remove any particles of dirt that might be in the developer, and in the tray.

411. **Judging the Proper Amount of Carbonate to Use when First Starting to Develop.**— Bear in mind that you can hardly use too little. It is better to start with too little carbonate than too much. You can always add the carbonate solution, but you cannot very well change it if you have added too great a quantity. Ten to twelve drops is usually sufficient to start with. If the image does not appear inside of two minutes add three to five drops more, and do not add any more for at least another minute, for when the developer once has sufficient carbonate it will develop quite rapidly.

412. **Plate Appearing to Develop Properly but the Highest Lights Not Gaining Sufficient Strength.**— This would signify that you used too much carbonate. Add a very small quantity of the pyro stock solution, also a few drops of bromide; at times a few drops is all that is necessary to produce the desired results.

## CHAPTER XV.

## HYDROQUINONE AND EIKONOGEN — NON-STAINING AND NON-POISONOUS DEVELOPER.

413. Although there is no developing agent that can equal pyro for the best general results, yet some object to its use owing to it staining the fingers when proper care is not exercised.

414. While either, metol or hydroquinone make a good developing agent, yet metol to some users is poisonous, and therefore, undesirable; consequently, the best developer that will not stain the fingers, and is not poisonous, is hydroquinone and eikonogen.

415. This developer can be altered to produce most any desired results; while it does not produce the printing quality in the negative that pyro does, yet it serves as the nearest developing agent to pyro that is practical for all developing purposes, with the least objection.

416. This developer can be used repeatedly for several batches of plates, but for the best results should be made up fresh for each day's work. It is desirable to save the developer of one day's use for the developing of plates you believe to be over-exposed slightly, and after starting the plate in normal developer, and you found it to be over-exposed, transfer to the tray containing the old developer, and allow it to remain in this solution until it takes on sufficient strength, then transfer to the normal developer for final developing. You will find that plates developed with this developer prepared exactly according to formula will have a very fine grain,

and the color will be very near that of a pyro developed negative. The shadows and highlights will be clear and with good detail.

Formula for hydroquinone and eikonogen developer: —

STOCK SOLUTION, NO. 1.

| | |
|---|---|
| Hydroquinone | 40 grains |
| Eikonogen | 120 grains |
| Sulphite of Soda (Anhydrous) | 1 ounce |
| Citric Acid | 20 grains |
| Water | 10 ounces |

STOCK SOLUTION, NO. 2.

| | |
|---|---|
| Bromide of Potassium | 5 grains |
| Carbonate of Soda (Anhydrous) | 60 grains |
| Caustic Soda (Sodium Hydrate) | 30 grains |
| Water | 10 ounces |

(If crystals sulphite or carbonate are used, use double the quantity.)

Mix all the chemicals in the order given.

For use take one ounce of each of the stock solutions, and add one ounce of water. This will then give you three ounces of developer, sufficient for the developing of a 4 x 5 plate. If the factorial method is employed for this combination developer the factor would be eight.

417. **Acid-Fixing Bath.**— The plain fixing bath has the disadvantage of becoming dark and discolored when organic developers are used, and, consequently, it is liable to stain the plate. This is overcome by using the acid-fixing bath according to the following formula: —

| | |
|---|---|
| Water | 80 ounces |
| Hypo | 4 ounces |

Dissolve and then add citric acid one and one-fourth ounces. After this has been dissolved add hypo sixteen ounces. When the ingredients are all dissolved the bath is ready for use, and plates should be fixed at least twenty minutes.

418. **Nature and Action of Chemicals Used.**—HYDROQUINONE.—The action in developing of hydroquinone is much slower than that of eikonogen, but it is more constant, lasts a great deal longer and produces more contrast. When used alone the negatives produced are apt to be too contrasty. While it gives a fine black velvety color, it does not give the blue-black as the eikonogen. It being slow in action, it allows for all color latitude in exposure, and is, consequently, easily controlled. Hydroquinone comes in the form of yellow, nearly white, needle-like prisms, and is very soluble in water.

EIKONOGEN.—The action of eikonogen in the developer is similar to hydroquinone. It is, however, much more energetic in developing than hydroquinone. It inclines to produce softness, and an abundance of detail. The action is so rapid when used alone, especially in the case of over-exposure, that combined with its quality in producing softness it is apt to cause fog. It is for this reason that the hydroquinone, which is much slower as a developing agent and contrast producer, is added. The color produced with eikonogen is blue-black negatives, with a very fine grain. It is non-poisonous, and does not stain the fingers. Eikonogen comes in small white-gray crystals, and dissolves slowly. From the description of these two developing agents you will readily see why they have been combined—one producing too much softness, and the other too much contrast when used alone. Eikonogen alone would also develop too rapidly, and would be apt to fog the negative; hydroquinone alone would develop too slowly, and produce too much contrast. Consequently, the two combined in the proportion given in the formula supplies a well-balanced developer.

419. **Carbonate and Sulphite of Soda.**—The sulphite and carbonate of soda act exactly as they do in the pyro developer, the carbonate opens the pores, and the sulphite controls the color of the negative.

420. **Caustic Soda (Sodium Hydrate.)**—Is a white, transparent, brittle substance very soluble in water, and strongly alkaline, used in the developer as an additional accelerator.

421. **Bromide of Potassium.**—Bromide of potassium is a white crystal used as a restraining agent. It restrains the development and holds the shadows clear throughout the developing.

422. **Altering Developer.**—While this developer can be altered to produce any desired effect, yet it is advisable to develop for some time with the regular formula as given until you become thoroughly familiar with the results to be produced. If after having some experience you find the developer working a little contrasty, you can produce more softness by reducing the amount of hydroquinone. For instance, instead of using forty grains of hydroquinone use thirty-five, and if this does not give you the desired softness, then increase the eikonogen to 130 grains. Care must be exercised that you do not use too much of the eikonogen, as it is apt to produce fog. In case of too much softness with the regular formula, increase the hydroquinone to forty-five grains, and if still too soft and a lack of contrast, increase to fifty grains. Just remember that hydroquinone will give you contrast, and eikonogen softness, so you can alter your developer to produce whatever results you desire. Both chemicals being powerful, the alteration should be made with but a few additional grains at a time, and a small quantity of stock solution should be prepared to experiment with. When you once obtain a well-balanced developer, do not alter it, for too much altering usually causes confusion, and leads to many failures. The formula as given will give you a well-balanced developer for all ordinary purposes, and unless the results are very much out of the way, it is not advisable to alter the proportion, but use the developer according to formula, and in case of too much harshness, indicating under-exposure, manipulate the developer with Special Stock Solution No. 3, made as follows:—

423.

| | |
|---|---|
| Water | 10 ounces |
| Eikonogen | 120 grains |

This solution must be kept in a bottle and the bottle well wrapped and with good stopper. In case of too much con-

trast, harshness, remove the plate from the normal bath, and add from ten to twenty drops of No. 3. Mix well, and return the plate to this developer, and conclude the developing in this bath. Eikonogen is a detail-producing chemical as well as developing agent, and by increasing the amount of this chemical within the limit to avoid fog, usually an under-timed plate would be very much improved, and a good negative will result.

424. If you find the plate you are developing is over-exposed treat according to instructions on developing over-exposures, and either add a few drops of ten per cent. solution of bromide to every ounce of developer you use, or transfer to old developer, which of course contains bromide liberated from the plates which were previously developed in this developer. If extremely over-exposed, soak in the bromide solution before developing. Follow instructions given in developing over-exposures with pyro developer.

425. In cases of extreme under-exposure after the plate has started to develop, and the image appears contrasty and weak in the shadows, place the plate in a tray of fresh water. In the meantime add to the bath one ounce of No. 2, two ounces of water, and a few drops of bromide. The bromide will prevent the fog and give the eikonogen and accelerators a chance to act on the shadows. Complete the developing in this bath. By means of Special Stock Solution No. 3, and the bromide solution you have absolute control of plates under all conditions, and by working carefully and using judgment any desired result can be obtained. All stock solutions must be kept in tightly corked bottles, glass stoppers preferred. Have the bottles brown or yellow. If plain glass bottles are used, wrap with dark paper, and place them in a dark, cool place in the dark room.

## CHAPTER XVI.

# METOL-HYDROQUINONE AND METOL-ADUROL COMBINED DEVELOPER FOR NEGATIVES AND LANTERN SLIDES.

426. The various developers mostly show in their character considerable variation. Each has its special merit, which makes it suitable for a particular work. In order, therefore, to combine developers of these special properties, the various developers can be applied in a mixed form, and a great deal of use is made of such processes.

427. For these combinations metol and hydroquinone, and metol and adurol, are those which deserve the greatest attention, and have, consequently, found the most use. These combinations are distinguished from all others in a remarkable manner, as the properties, or the components, do not simply combine, but they also increase considerably in efficacy. For instance, metol-hydroquinone works with greater energy than metol alone, and gives more density than hydroquinone alone. The reason for this is that when combining metol and hydroquinone it is not simply a mixture, but at the same time in the alkaline solutions, an actual chemical combination takes place, which again possesses other properties than the components.

The fact that metol-hydroquinone develops more quickly than metol and gives more density than hydroquinone, makes it preferable in some instances for use in the studio and for instantaneous photography, as it permits in both cases of shorter exposure, and works more rapidly.

428. Metol-hydroquinone, in its class, is the most popular developer of the day, and forms the main substance of nearly

all the ready solutions which are on the market. It is the most popular developer for developing papers, and for obtaining clean black tones on bromide paper it is unsurpassed. For negatives, especially lantern plates, it is probably the most used developer, outside of pyro.

429. **Metol-Hydroquinone Developer.** — Being a very rapid developer, will completely develop a plate, or film, in from two to six minutes. It is recommended for lantern slides, and film developing in particular, but serves as a good plate developer as well. The color of the negative is inclined towards a blue-gray, and, therefore, plates other than lantern plates developed with this bath should be carried a trifle further in development than if developed with pyro, for the pyro gives a brown colored negative which produces vigorous prints, even from a thin negative. While the metol giving a blue-gray negative, if developed thin, will produce flat prints, where if carried a little further in the developing, better prints will result. For lantern slides the blue-gray tone is preferred, and therefore this combination serves as a good developer. Any result may be obtained by manipulating the developer. Certain rules must be observed, however. Deep black tones can only be obtained with short exposures, and strong developers (concentrated solution, and little bromide); warm tones going into brown can be obtained with longer exposure and retarded development (diluted solutions, little alkali and much bromide of potash). The best plan is to follow the instructions given with each kind of lantern plates. It must be observed that with a long duration of development of the lantern plates the plate will become colored, and it is, therefore, important that you develop quickly; two to three minutes is best. Underexposed images are best discarded, generally speaking, especially for obtaining black tones.

430. Metol, to some users, is poisonous and therefore objectionable. Many however are using metol developer without any ill effects whatever, and for those who can use it they will find the formula stated herein to give very good results: —

METOL-HYDROQUINONE FORMULA.

| | |
|---|---|
| Water | 50 ounces |
| Metol | ¼ ounce |
| Hydroquinone | 1 ounce |
| Sulphite of Soda (Anhydrous) | 3¾ ounces |
| Carbonate of Soda (Anhydrous) | 5½ ounces |

Dissolve the chemicals in the order indicated in the formula, and for use prepare as follows:

To every ounce of this concentrated Stock Solution add eight ounces of water, making nine ounces of solution. One-half of this amount is sufficient for the developing of a 4 x 5 plate.

431. If the factorial method for developing is employed with this combination formula, you will find ten as the factor, and it will completely develop plates in six minutes, and for tank development, by substituting ten ounces of water to every one ounce of concentrated stock solution, you will have an eight minute developer. Slow development with this metol formula is very apt to produce fog; therefore the best results are obtained when development is completed within eight to ten minutes.

432. Metol-hydroquinone keeps better, and consequently is more economical than other developers. The solutions can be used until entirely exhausted. The following are a few additional formulæ that will give good results, and are particularly good for lantern plates: —

No. 1. *A Two-Solution Metol-Hydroquinone Developer.*

SOLUTION *A*.

| | |
|---|---|
| Water | 35 ounces |
| Metol | 115 grains |
| Hydroquinone | 115 grains |
| Sulphite of Soda (Crystals) | 5¼ ounces |

If Anhydrous Sulphite is used, use 3 ounces.

SOLUTION *B*.

| | |
|---|---|
| Water | 35 ounces |
| Carbonate of Potash | 3½ ounces |

NOTE.— Carbonate of Soda may be substituted for Potash, as follows: —

| | |
|---|---|
| Carbonate Soda (Anhydrous) | 4 ounces |
| Or, Carbonate Soda (Crystals) | 8 ounces |

433. The metol and hydroquinone must be dissolved before the sulphite of sodium is added. For use take one part *A*, one part *B*, one part water, and add, as required, from five to fifteen drops bromide of potassium. It is also permissible to originally add to this Solution *B* a few drops of bromide of potassium, as it will do no harm. The temperature for development should not exceed sixty-eight degrees Fahr. Duration of development from three to four minutes. The previously used developer can be employed repeatedly.

No. 2. *Metol-Hydroquinone One-Solution Developer.*

| | |
|---|---|
| Water | 35 ounces |
| Metol | 115 grains |
| Hydroquinone | 115 grains |
| Sulphite of Soda (Crystals) | 5¼ ounces |
| Carbonate of Potassium | 5¼ ounces |
| Bromide of Potassium | 8 grains |

NOTE.— If Anhydrous Sulphite is used in place of Crystals, use three ounces.

Carbonate of Soda may be substituted for Potash, as follows:

| | |
|---|---|
| Carbonate of Soda (Anhydrous) | 6 ounces |
| Carbonate of Soda (Crystals) | 12 ounces |

434. The metol and hydroquinone must be dissolved before the sulphite of soda is added. For use take one part solution to three parts of water. The temperature for development should not exceed sixty-eight degrees Fahr. The image, when applying this developer, will appear almost instantaneously, and development is completed in about three minutes. The used developer can be employed repeatedly.

### *Metol-Adurol.*

435. With advantage sometimes adurol takes the place of hydroquinone in combination with metol, and it has the advan-

tage of working more clearly, and dissolving more easily, while its keeping properties are still greater. Concentrated solutions can therefore be made which are especially adapted for amateurs. Metol-adurol works in a similar manner to metol-hydroquinone, and is very economical. It is equally as good a developer for paper as for plates, and is especially good for lantern plates. Metol-adurol in the combination given, in spite of its rapidity, can be easily controlled with bromide of potassium, and especially the used developer can be applied as advantageously for over-exposures. Metol-adurol is a good developer, which above all others best combines the advantages of a rapid developer with variation, and may therefore be recommended as a universal developer for studio work for those who do not care to use pyro.

FORMULA NO. 1. *Metol-Adurol Two-Solution Developer.*

| | | |
|---|---|---|
| *A* | Water | 35 ounces |
| | Metol | 75 grains |
| | Adurol | 150 grains |
| | Sulphite of Sodium (Crystals) | 3½ ounces |
| | Or, if Anhydrous Sulphite is used | 2 ounces |
| *B* | Water | 35 ounces |
| | Carbonate of Potash | 3½ ounces |

NOTE.—If Carbonate of Soda is used in place of Potash, take

| | |
|---|---|
| Carbonate of Soda (Anhydrous) | 4 ounces |
| Or, Carbonate of Soda (Crystals) | 8 ounces |

436. The metol and adurol must be dissolved before the sulphite is added. For use prepare as follows: For rapid development take one part *A*, one part *B*. Duration of development two to three minutes. For slow development take one part *A*, one part *B*, one part of water, and add from five to ten drops bromide of potassium. Duration of development from three to four minutes. The temperature of the developer should not exceed sixty-eight degrees Fahr. Previously used developer can be repeatedly employed.

FORMULA NO. 2. *Metol-Adurol One-Solution Developer.*

| | | |
|---|---|---|
| Water | 35 | ounces. |
| Metol | 150 | grains. |
| Adurol | 2 | ounces. |
| Sulphite of Sodium (Crystals) | 10½ | ounces. |
| Or, if Anhydrous Sulphite is used, use | 6 | ounces. |
| Carbonate of Potassium | 8¾ | ounces. |
| Bromide of Potassium | 20 | grains. |

NOTE.—If Carbonate of Soda is used in place of Potash, take

| | | |
|---|---|---|
| Carbonate of Soda (Anhydrous) | 9 | ounces. |
| Carbonate of Soda (Crystals) | 18 | ounces. |

437. The metol and adurol must be dissolved before the sulphite is added. For use prepare as follows: For rapid development take one part solution to five parts water. Duration of development from two to three minutes. For slow development take one part solution, and fifteen parts water. Duration of development about five minutes.

438. Metol-adurol developer, on account of its small contents of metol and larger contents of adurol, is very easily variable. A few drops of bromide of potassium suffices to retard development. Where you have a plate of strong over-exposure take a previously used developer with the further addition of bromide of potassium. A still better plan is to take less potash for the developer, in which case the influence of the bromide of potassium is strong. Take, for instance, for formula No. 1, forty parts *A* to ten parts *B*, fifty parts water, five parts bromide of potassium. For Formula No. 2, fifteen parts solution, eighty parts water, five parts bromide of potassium. Where over-exposure has not been so great the used developer suffices for development. For unknown exposure always commence with the used developer, and correct according to requirements.

For fixing use the acid-fixing bath, prepared as follows:—

| | | |
|---|---|---|
| Water | 80 | ounces. |
| Hypo | 4 | ounces. |
| Dissolve and then add, citric acid | 1¼ | ounces. |
| After this is dissolved add, hypo | 16 | ounces. |

WAVE ACTION

## CHAPTER XVII.

## AMMONIA DEVELOPING.

439. **Developing Instantaneous Exposures with Ammonia Developer.**—The ammonia developer is not recommended for general work, nor even for special work, but is included in this instruction for the benefit of the few who wish to go to the extremes with experiments, for any reasonable and positive result can be obtained from any of the previous formulæ given. There are extreme cases, however, where ammonia developer is an advantage, and to cover these cases is the object of this instruction. The amount of ammonia to be used in this developer depends to a large extent upon the exposure. Unless the proportions of the developer are prepared according to the exposure given the plate there is danger of fog. For extremely under-timed plates some like the ammonia developer, as more detail can be coaxed out with the ammonia as an accelerator than any of the sodas, and this formula is, therefore, supplied for these extreme cases only. We do not advise using the ammonia developing formula given in this instruction for regular exposures, or snap shot work made with the ordinary shutter, but for extremely short exposure, or those made with focal-plane or similar extremely rapid shutter giving less than $\frac{1}{250}$ part of a second exposure in bright sunlight, and not more than $\frac{1}{150}$ part of a second in dull light. This class of instruments are usually used on moving objects, such as running or jumping horses, cattle,

birds and trains, or cars in motion, athletic sports, or any rapid moving object requiring most rapid exposure, and a quicker exposure than can be given with the ordinary shutter, for all such objects must be photographed without any blur, and to do so the shutter must move across the sensitized plate more quickly than the object being photographed. There are times also in slightly cloudy weather when one must make exposures of moving objects which could not be obtained at any other time. All such exposures if developed in the ordinary way would be considered under-timed, and even if they were treated as such (with the ordinary developing), if the exposure should be extremely short, one would not obtain as much detail and solidity as it is possible to obtain with the ammonia developer, providing the developer is properly balanced.

440. The alkalies used in ordinary developing are usually some soda of a strong, harsh nature. This strong alkali, if used on extreme under-timed plates, even with a very much diluted developer, has a tendency to choke and clog the highest lights, and the shadows being so very meagerly exposed the soda does not have the same action as it does on the more fully exposed parts. While the ammonia acts just the reverse, it is of a more penetrating nature, and has a tendency to attack the least exposed parts the most; therefore, the shadows being the the least exposed it attacks them first. In the developing of this class of exposure, we must assume that these plates are of short exposure, or extremely under-exposed, and while in previous instruction the treatment for the development of under-exposed plates has been pretty thoroughly covered, yet the former training dealt with general exposure of portraiture, interior, landscape and architectural photography. The formula in this instruction, however, is intended purely for the plates that are very much under-exposed, and for extremely rapid instantaneous photography. In such pictures the main object is to show the subject in motion, and to get the image perfectly sharp the exposure must necessarily be extremely short, and there must be enough detail and strength in the negative to supply the proper print-

ing quality. In previous instruction on developing you have been advised as to the proper color of the negative, which should be a slight tinge of brown. In this case of extreme under-exposure, however, you will find that many times a *very thin* negative with a yellow color will produce prints of much finer quality than extremely thin plates of a brown color, such as is required for ordinary portraiture, architectural or landscape views, where the full exposure was given; for with the extremely thin plate the color of the plate slows the printing, and thereby adds strength to the shadows, thus supplying more brilliant prints.

441. In the early days of the dry plate, ammonia was universally used as an alkali in place of carbonate of soda, which is generally used to-day. The principal reason for discarding ammonia was, that the negatives generally obtained with this ammonia alkali were extremely yellow, and the latitude in development was limited, and if plates were carried a trifle too far in the developer the prints produced from them would be contrasty, with strong highlights, and hard shadows. Ammonia developer has its advantages, especially in the developing of instantaneous exposures, because its accelerator properties are much stronger, rendering the solution very alkaline, yet not harsh, and enhancing its deoxidizing power. It also possesses the advantage over all other alkalies of giving greater vigor; thus its action is quicker, and with the under-exposed plate very easily controlled, while for normal or full-timed exposure ammonia accelerator would be more difficult to control, and better results can be obtained with other accelerators.

442. The following formula will produce most excellent results, and can be altered, or the developer manipulated during development to suit most any rapid exposure: —

FORMULA.

| | |
|---|---|
| Water | 10 ounces |
| Pyro (dry) | 20 grains |
| Bromide of Potassium | 10 grains |
| Ammonia (specific gravity 800) | 20 drops |

It is necessary that the ammonia be concentrated ammonia, the ordinary commercial ammonia is too weak, and should

not be used. If, however, the former cannot be obtained, and you are compelled to use the weaker ammonia, then you will need to use a larger quantity of it — sufficient to make up for the difference in strength.

443. As the ammonia evaporates rapidly the developer should not be made up until you are ready to use it. The proportions given in the formula above are just right for normal developer, and should be used without diluting unless the plate is extremely under-exposed, then you should double the quantity of water used, making twenty ounces in all.

444. With the ammonia developer on an under-exposed plate the image will appear a little quicker than with soda accelerators, but after the image is plainly visible the developing will be extremely slow, as the ammonia evaporates very rapidly and you will, therefore, from time to time need to add a few drops of ammonia, replenishing that which has evaporated. The very fact that the developer acts slowly will prevent the highlights from piling up and growing too strong before there is sufficient detail in the shadows, which would be the case if carbonate of soda were used.

445. The bromide of potassium provided for in the formula in excessive quantities, no doubt will seem strange to you, for in your past instruction you were told to use bromide of potassium as a restrainer for plates which were over-exposed. In this case, however, the bromide is used in excessive quantities to protect the plate from fog, as the ammonia is very apt to fog the shadows unless restrained with bromide. As ammonia has a tendency to attack the shadows, or the least exposed parts first, the bromide does not have the effect of restraining them, but merely holds them clear of fog, thus enabling the developing agent to act more freely.

446. **Developing of Plates.**— Having carefully prepared your developer, according to the formula, place the exposed plate in the tray, and flow with a sufficient quantity solution to thoroughly cover it with one sweep. Use plenty of developer. Avoid rocking the tray more than is absolutely necessary. Carefully watch the plate, and within a reasonable time the image should appear. If after the image ap-

pears it continues to grow right along, you will know the exposure is all right for the developer you are using. If within a few minutes after the image appears the action of the developer is slow and lagging, you will know that the plate was extremely under-exposed. You should then add enough water to make double the quantity of solution, and cover the tray, excluding all light, and continue the developing, and if the developing appears still to lag, every five or ten minutes add two drops of ammonia for every ounce of developer that you are using. This additional ammonia is to take the place of the ammonia which has naturally evaporated. When you have obtained sufficient density in the highlights, then your plate is sufficiently developed, and you should wash and fix the plate in the usual way. The temperature of the developer should be between sixty-five and seventy degrees. The colder the developer the slower the action. If the developer is too warm the action would be rapid, and the plate would have a tendency to soften, frill and fog in the shadows. If you find after fixing the negative it is extremely yellow, you can remove this color, or part of it at least, by clearing with the alum clearing solution according to the formula given in lesson on REDUCING. Before clearing, however, unless the shadows appear with good strength, it is advisable to dry the negative, and make a proof before removing the color, as oftentimes the yellow color in a negative is the salvation of an extremely under-exposed plate with weak shadows, for it slows the printing and permits the light to penetrate deeper into the shadows, resulting in a much more solid print.

447. CAUTION.—Do not add more ammonia to the developer until you require it; that is, when the developing appears to have ceased, and the plate is very thin and lacks strength, then add more ammonia, and add it cautiously. Remove the plate from the developer while adding the ammonia, and rock the tray to thoroughly mix the ammonia with the developer, then return the plate to the developer. Too much ammonia will cause a fog, so work cautiously, and after a few experiments you will be able to judge to the drop how much ammonia to add, and by the proper care and pains you can pro-

duce negatives with fair detail in the deepest shadows from plates that if developed with soda developer would render almost clear glass. This formula and method of development is only recommended to those who have carefully worked all the previous developers and formulæ given in this volume, for as each different formula is given for a particular purpose it is taken for granted that the reader has had the benefit and experience of all the previous instructions before attempting to apply this method, and for the large majority of exposures any of the former formulæ are preferable. Even for instantaneous work usually the metol-hydro developer will, if properly manipulated, render all detail that the given exposure will supply. But those who enjoy experimenting will find some interesting results can be obtained with ammonia developer; yet it is not always reliable, and therefore is not recommended. Proof prints should be made from each experiment, with complete data noted on the back. This data will aid you in your future experiments, and therefore proofs and all data should be carefully filed.

## CHAPTER XVIII.

## FACTORIAL DEVELOPMENT.

448. By factorial development is meant the technical method of development in which the process of developing is regulated solely by mathematical figuring, when certain conditions exist. It is the object of this instruction to thoroughly consider these conditions, and to make the subject of factorial development so simple that even a person who has had little or no experience in negative making can take the exposed plate and having received the instructions necessary for proceeding to develop by the factorial method, be able to produce an excellently developed negative.

449. **The Factor.**— The factor is the agent or the means by which is found the required length of time that the exposed plate must remain in a developing solution composed of a certain developing agent. Originally the factor is found by developing a normally exposed plate in the usual manner, regardless of the nature of developing agent, and in this case, of course, it is necessary, in order to obtain an accurate factor, that the person who develops the plate has a perfect knowledge of the requirements of an ideal negative.

450. **Obtaining the Factor.**— In order to obtain the factor for developing, after carefully preparing the bath according to the formula, see that the temperature is sixty-five degrees Fahr.; then place a normally exposed plate in the bath, and observe the time required for the strongest highlights of the image to appear fully with the general outlines, also faintly visible. The rapidity of this appearance indicates the speed of the developer. The relation between this time of appearance and the total time to develop is the factor, and

all future baths made according to the same formula, and of the same temperature, will completely develop plates in the same time. To make this more clear, before placing the normally exposed plate in the normal developer note the time by your watch or clock, then place your plate in the developer, watch the action of the solution upon the plate, and as soon as the highlights appear fully and a general outline is slightly *visible*, again note the time, and see exactly how many seconds were required for development to this stage; or, in other words, how many seconds the plate was in the developer. Make a note of this number of seconds, and of course the negative continues developing, and when the plate is completely developed again note the total number of seconds (or minutes reduced to seconds), required for development from the placing of the plate in the developer until it is completely developed. Now divide the total number of seconds by the number of seconds recorded for the first appearance of the highlights, and this result is your factor.

451. When the factor is once found by the method above described, that factor will always hold good in case of a developing solution mixed according to the particular formula used in the test. If another developing agent is employed it is necessary to make another test, and find a factor for that particular developer. Where we have a combination of different developing agents, such as metol-hydroquinone, metol-pyro, etc., separate factors must be obtained for each agent, and the proportionate amount of each used in the formula must be considered in computing the factor for the combination formula. As we supply the Watkins' table of factors of practically all the developing agents, it will not be necessary that you make this test unless you have a particular formula which does not come under the accompanying table. Should that be the case, you will be able to obtain a factor by following the directions given above.

452. **Temperature.**— The temperature ot the developer is of the utmost importance, as high temperature hastens the action, and lower temperature retards the action. Sixty-five degrees Fahr. should be a normal temperature, and all devel-

oping solutions, in order to be accurate, should be of the same temperature. A few degrees one way or the other, however, will do little or no harm, but one should strive to retain the normal temperature.

453. One of the chief difficulties in obtaining a factor lies in the accurate judgment by different persons of the time of appearance of the image, and not only is this true of different persons, but the same person at different times when developing exposures under varying conditions, for instance plates with strong highlights and plates with soft highlights as in misty scenes, etc., may estimate the appearance of the image as being shorter in some cases and longer in others. The only real accurate way to obtain the factor for a certain developer which you wish to employ, would be to make an exposure on some object with medium highlights, and develop it, and obtain your factor from this plate; then all other plates under any and all conditions can be developed by the same factor.

454. It is argued that with a long factor the multiplication of any error, engaging the exact time of appearance, will greatly increase the total length of development, thus producing negatives of undue density, and probably incorrect gradations, but the longer the factor the greater is the latitude, and this makes up, to a certain extent, any variation in judging the appearance of the image.

455. **Developing Light.**—It is essential that you always have a liberal allowance of light in the dark room (of course non-actinic), for this is of the highest importance while watching for the first appearance of the image. If average care is used the slight variation of judging the first appearance of the image is of comparatively small importance and, in fact, is much less likely to cause variations in the results than with the old system of judging density by inspection. Some individuals are occasionally quicker or slower in noting the appearance of the highlights than others, but as a rule this variation is uniform, and may be allowed for by adopting a proportionately higher or lower factor for the same developer.

456. When you have a given factor for a certain developer, you may proceed to pour the developer on your ex-

posed plate, keeping exact time required for the image to appear, then multiply this time by your factor, and the result will be the number of seconds required for the plate to remain in the developer. If you wish to change this time to minutes, simply divide your result by sixty (60).

457. **Effect of Different Developing Agents.**— Pyro and amidol are different from all other developing agents, when considering the factorial system. With all other developing agents the factor does not alter, to any great extent, with strength or dilution, but with pyro or amidol the factor varies with the strength in grains to the ounce in solution. The use of bromide of potassium (or its omission), also alters the factor greatly with pyro and other short factor developers, such as hydroquinone, etc., while with the longer factor developers, such as metol, etc., the bromide has but very little effect. In pyro, and other short factor developers, the addition of bromide in the proportion of one-fourth grain to each grain of pyro will cut the factor in half.

458. Variations in the amount of alkali (carbonate of soda or potash) in the developer, does not alter the factor. As a general rule the factor for different brands of plates or films, which is right for one brand of plate, or film, is also correct for another make of plate or film. It is true that some plates develop much more quickly than others, but the time of appearance, which is the key to the total time required for development, makes due allowance for this.

459. For orthochromatic, or any double coated plates, the factorial method is almost indispensable, for they, above all plates, are the most difficult to judge when they are completely developed, owing to their special coating; but as the factor is the same for all plates, all you need do is to note the time of appearance of the highlights and multiply that time by your factor, and the result is the time at which your plate is completely developed.

460. Mr. Watkins, who is an authority on factorial development, gives the following table of factors, which will prove quite accurate and convenient:—

TABLE OF FACTORS.

| DEVELOPER | FACTOR |
|---|---|
| Amidol (2 grains per ounce) | 18 |
| Edinol | 20 |
| Eikonogen | 9 |
| Hydroquinone | 5 |
| Metol | 30 |
| Metol-Hydroquinone | 14 |
| Rodinol | 40 |

PYRO DEVELOPERS.

| | |
|---|---|
| 1 grain Pyro per ounce solution | 18 |
| 2 grains Pyro per ounce solution | 12 |
| 3 grains Pyro per ounce solution | 10 |
| 4 grains Pyro per ounce solution | 8 |

PYRO WITH BROMIDE.

| | |
|---|---|
| ¼ gr. Bromide to 1 gr. Pyro per oz. solution | 9 |
| ½ gr. Bromide to 2 grs. Pyro per oz. solution | 5 |
| 1 gr. Bromide to 4 grs. Pyro per oz. solution | 4 |

461. **Developing with Different Factors Regulates Speed of Developer.**—The following formulæ are given for regular pyro developers prepared by the factorial system for the developing of plates in four, ten, twenty and twenty-five minutes. For the convenience of the reader we will apply our regular universal pyro developer for use in this illustration:—

462. STOCK SOLUTION NO. 1.

| | |
|---|---|
| Water | 6 ounces |
| Sulphuric Acid C. P | ½ dram |
| Pyro | 1 ounce |

STOCK SOLUTION NO. 2.

Procure a 20-ounce bottle. Into this pour 1 ounce Stock Solution No. 1, and add 16 ounces of water.

STOCK SOLUTION NO. 3.

Sulphite of soda 40 hydrometer test, or by weight,

| | |
|---|---|
| Sulphite of Soda (Anhydrous) | 1 ounce |
| Water | 13 ounces |

STOCK SOLUTION NO. 4.

Carbonate of Soda (Anhydrous), 20 hydrometer test; or if by weight,

| | |
|---|---|
| Carbonate of Soda (Anhydrous) ..... | 1 ounce |
| Water..... | 23 ounces |

If Crystal Sodas are used, double the quantity in weight.

Use only the very best chemicals. We would recommend Seeds, Cramer's or Mallinckrodt's anhydrous C. P.

463. **Preparing the Stock Solution.**— In order to avoid early discoloration of the Pyro Stock Solution, it is advisable to acidify the water before adding the pyro; therefore, this solution should be mixed up in the regular order: Into six ounces of water pour one-half dram of sulphuric acid. This acidifies the water. Then add to this one ounce of pyro. As you have one ounce of pyro to six ounces of water, there is in each ounce of solution one-sixth of an ounce of pyro. To reduce this to grains, divide 480 (the number of grains in an ounce), by six, which gives a result of eighty. Therefore, the grain strength of the pyro per ounce of the water will be eighty; or, in other words, you will have eighty grains of pyro to each ounce of water.

464. In order to prepare this Pyro Stock Solution for use, take one ounce of this Stock Solution, and dilute with sixteen ounces of water. This makes your Solution No. 2, and you have five grains of pyro to each ounce of this solution, for in taking the above mentioned eighty grains which were in each original ounce of Pyro Stock Solution, and adding this to sixteen ounces of water, you will have about seventeen ounces of solution to eighty grains of pyro, and when uniformly distributed throughout this bulk of water there will be in each ounce $\frac{1}{17}$ of eighty, or 4.7 grains per ounce, or very nearly five grains of pyro per ounce of solution.

465. Solution No. 3 is made up of sodium sulphite, testing forty degrees by the hydrometer, while Solution No. 4 is composed of sodium carbonate, testing twenty degrees by the hydrometer.

466. **Mixing the Developer.**—To mix the developer take of Solution No. 2, four ounces, and as each ounce of this solution contains five grains of pyro, the four ounces will contain twenty grains. Add to this, two ounces of Solution No. 3, and two ounces of Solution No. 4, making a total developing solution of eight ounces. You now have eight ounces of solution, and in this are twenty grains of pyro; therefore, the number of grains of pyro per ounce of solution will be one-eighth of twenty, or two and one-half grains per ounce. Therefore, the grain strength of this developer is two and one-half, and the factor for this developer is twelve.

467. **Finding the Factor.**—We found the factor in the following manner:—A normally exposed plate was placed in this developing solution (the temperature being sixty-five degrees Fahr.), and the image appeared in exactly twenty seconds. The development was completed in exactly four minutes, or two hundred and forty seconds. Divide two hundred and forty (the total length of time), by twenty (the time required for the image to appear), and this gives a result of twelve. Thus twelve is the factor for this developer, and all plates developed in this bath will develop in approximately four minutes.

468. **A Ten-Minute Developer.**—If you desire a ten-minute developer, take the above solution (eight ounces), and add to it an equal bulk of water (eight ounces). You will then have a total bulk of solution amounting to sixteen ounces, in which is distributed twenty grains of pyro. Dividing the twenty by sixteen gives one and one-fourth grains of pyro per ounce of solution. With the developer at sixty-five degrees Fahr., and a normally exposed negative, we found the image to appear in twenty-five seconds, and it was fully developed in six hundred seconds (ten minutes); therefore, six hundred divided by twenty-five gives twenty-four, making the factor for this particular solution twenty-four, and a plate developed in a solution diluted as above will develop in approximately ten minutes.

469. **A Twenty-Minute Developer.**—A twenty-minute developer is secured by taking the above mentioned develop-

ing solution (eight ounces), and adding to the developer double the quantity of water (sixteen ounces), making twenty-four ounces of solution in which you have twenty grains of pyro. Divide this twenty by twenty-four, and the result will be five-sixths; therefore, you have five-sixths of a grain of pyro per ounce of solution. We found the image on a normally exposed plate to appear in this developer when the solution was at sixty-five degrees Fahr., in thirty seconds, and the development was completed in 1170 seconds (nineteen and one-half minutes). The factor for this developer is, therefore, $\frac{1}{30}$ of 1170, or thirty-nine. Although the exact time of development of this developer is nineteen and one-half minutes, the latitude for a developer of this dilution is so great that no harm will be done in developing the plate for twenty minutes; and for tank development, where you do not desire to look at the plate after it is placed in the developer, you will find that leaving it in this solution from twenty to twenty-two minutes will give you good development for negatives which might vary in exposure, some being a little under-timed, some normally exposed, and others over-exposed.

470. **A Twenty-Five-Minute Developer.**—If you take the regular developing solution (eight ounces), and add enough water to make the total bulk thirty-two ounces, or just four times the bulk of the original solution, you will have five-eighths of a grain of pyro to each ounce of solution, and we have found that the factor for this developer is forty-eight. You will, therefore, see that by doubling the bulk of solution of the normal developer you will have just one-half as many grains of pyro per ounce of water, and the factor is doubled; while if you take four times the bulk of solution the grain strength of each ounce is reduced one-fourth, while the factor is four times as great. The average negative will develop in the above pyro developer when the factor is forty-eight in approximately twenty-four minutes, but if you are developing plates having varying exposures, and you are working with a developing tank, uniform development will be secured by leaving the plate in the developer for twenty-five minutes.

### METOL-HYDROQUINONE FORMULA.

STOCK SOLUTION.

| | | |
|---|---|---|
| Water | 24 | ounces |
| Metol | 15 | grains |
| Sulphite of Soda (Anhydrous) | 1¼ | ounces |
| Hydroquinone | 1 | dram |
| Carbonate of Soda (Anhydrous) | 5 | drams |

If Crystal Sodas are used double the quantity in weight.

Dissolve the chemicals in the order given.

471. **Ascertaining Factor.**—The factor of this formula is ten. In this formula we have two developing agents—metol and hydroquinone; and we have sixty grains of hydroquinone, or four times as many grains of hydroquinone as we have metol, the latter of which we have fifteen grains. These developing agents, as formerly stated, having different factors, we must ascertain the proportions used of each agent to the developer, and our factor is regulated accordingly. The factor of hydroquinone we know from the table of factors is "five," and for metol is "thirty."

472. Where we desire to take two different developing agents and combine them into one developing solution, the factor is approximately the average of the two constituents if in equal parts. Thus, with hydroquinone "five" and metol "thirty," if used in equal parts, the average will be "seventeen and one-half," but if the combined developer, as in this formula, contains four parts hydroquinone to one part metol (five parts in all), we must add the factors for all five parts (the factor for each part being the original factor for that particular developing agent), and divide by the total number of parts; thus $\frac{5+5+5+5+30}{5}=10$. Any combination of long factor developers can be obtained in this way, but a combination developer containing pyro does not conform to this rule, and its factor must be ascertained by actual trial.

473. A few facts should be remembered: The factor of all developers, except pyro and amidol, depends upon the developing agent, and not upon the formula. The varying of the quantity of water, or increase in alkali, or even the use of

bromide, may alter the time of the appearance of the image, but does not alter the effect of the long factor developing agents, such as metol, etc. Temperature effects the time of appearance, but does not modify the factor; however, with pyro and amidol for short factor developers the factor varies with the strength in grains to the ounce solution, but in all other developers the factor does not alter with strength or dilution.

474. **Retaining Normal Temperature.**—While under ordinary conditions one can work with an average temperature of from sixty to seventy degrees Fahr., yet there are times in very hot climates that the temperature is very high. In such cases a quick developer is preferable, for the quicker you can completely develop plates, fix and wash them, the better it will be for the resulting negative. However, where slow development is preferred one can, if they wish to go to the little extra trouble, arrange their baths so as to hold them at a certain temperature throughout the entire time of developing. First of all, the developing room should be kept cool, and by providing a "water bath" into which you place your developing tray, you can hold the developer to the temperature of the water.

475. If the temperature of the water is high, then the addition of a little ice in the "water bath" will reduce it to the proper state. For example, take a tray or dish larger than your developing tray and place water in this large tray, having the temperature of the "water bath" lower than normal, say 60 degrees Fahr., and if the temperature of the room is 68 or 70 degrees Fahr., place your tray containing the developer in this "water bath," and after a few minutes you will find the developing bath will become about normal, or 65 degrees. In cold weather the same method may be employed. Instead of using cold water, however, in the "water bath," sufficient warm water can be used to raise the temperature as much above that of your developer, or developing bath, as the temperature of the room is below normal, thus equalizing the temperature.

MARINE

STUDY No. 10 — S. I. CARPENTER

The above suggestions are intended for extreme cases only. Under ordinary conditions the extra "water bath" will be unnecessary.

### PRACTICE WORK.

476. In making your experiments with factorial development, after carefully reading the instruction for obtaining factors, etc., it is advisable for you to try out the formula given. First try the pyro formula, and after providing yourself with a few normally exposed plates, then proceed to prepare your pyro developer exactly according to the formula given. When you are ready to develop note the time by your watch, and at once place the plate in the developer, and observe the image as it appears. When the strongest highlights are clear, and the general outline slightly visible at this stage, take the time again and note the number of seconds it has required for the time of appearance, for this is the key to the proper results. Multiply this time by your factor, which will indicate the total time required for complete development. By applying the factor given in this instruction, the only mistake you are likely to make is in judging the time of appearance; and this you can become accurate in by experience and intelligent experimenting only.

477. After your first experiment, dry the negatives, and make proof prints from them, and note the results. Note on the back of the proofs the date, first or second trial, as the case may be. Note the time of appearance, the developer used, the factor employed, total time of development, and any other data that can be used for future reference. File these proofs in your letter file, under the title "factorial development." After a few experiments with our regular formula, change the formula and obtain a new factor, keeping a record of the change. Make proofs from each resulting negative, note formula on back of proofs, and the necessary data, and file as usual. In this way you will have a practical record of all your experiments.

478. After experimenting with the pyro formula, next

take up the metol-hydroquinone developer, and make your experiments, and prove all your results in like manner, making careful note of each experiment, and number each proof so that you can note your improvements from the first to the last.

## DIFFICULTIES—FACTORIAL DEVELOPMENT.

479. **Judging the Time of Appearance.**—This is perhaps the most difficult in factorial development, and can only be successfully accomplished by practice. Watch carefully the negative as the image first appears, as it will grow rapidly. The highlights must be watched carefully, and just as soon as the highlights are clearly visible, and the general outline very *slightly* visible, that is the proper time of appearance, and the number of seconds from the time the plate enters the developer until that stage is reached, is the key to your accurate developing. Now, if you allow the time of appearance to go too far—in other words, if your image be developed too far before taking the time, the result would be that your negative, when completely developed, would be strong; or, if it were not carried far enough when taking the time of appearance, as for instance, if you judge the time of appearance twenty seconds, and it possibly should have been thirty seconds, this time multiplied by the factor would shorten the necessary time for complete development, and consequently the plate would be under-developed.

480. **Obtaining the Factor.**—If you study carefully the instruction you should not have any difficulty in obtaining the factor. There are a few things very necessary that must be remembered.

481. *First.*—The factors for pyro and amidol developers are governed by the strength in grains to the ounce solution. In other words, to dilute a pyro bath changes the factor. Why? Because you at once change the grain strength to the ounce solution.

482. *Second.*—The factor for all other developers depends entirely upon the developing agent, and not upon the formula employed, and a factor does not alter with strength or dilution, but the time of appearance may be altered. For example, if the time of appearance with a normal metol bath was fifteen seconds, and the factor was thirty, that would indicate that in four hundred and fifty seconds the plate would be fully developed. Suppose we dilute the metol with equal amount of water, the time of appearance would be slower, perhaps twenty seconds. The factor is the same, and it will require six hundred seconds to completely develop the

plate. In other words, diluting the developer only prolongs the development, but does not change the factor in a metol, or long factor developer.

483. **Controlling the Temperature.**— It is not absolutely necessary that the temperature be exactly sixty-five degrees. Anywhere from sixty to seventy is safe, but beyond this limit you will experience trouble unless you test each batch of plates for time of appearance, and that is all the difference it makes in the accurate time of complete development. It is advisable in cases of very radical changes of temperature, and especially in very hot climates, that the time of appearance be taken for each batch of plates, and as results are governed entirely by time of appearance, you will experience no trouble, for while a bath at sixty-five degrees Fahr. might develop to-day in six minutes, to-morrow if the temperature of the developing room were sixty, the plate would develop fully in eight minutes. All is governed entirely by time of appearance, and you must work accordingly.

## CHAPTER XIX.

## TANK OR STAND DEVELOPING.

484. A great deal can be said in favor of tank development, yet unless one has carefully followed the previous instruction given on developing by the ordinary way, so that negative developing is thoroughly understood, it will not be possible to produce the desired results, or fully appreciate the value of this method of development.

485. Tank development is nothing more or less than developing with a diluted solution, causing slow development of the image, which latter is always commendable, for by means of weak solutions resulting in slow development, all classes of exposures may be developed in one and the same tank, and at the same time. The mechanical part of tank development is very simple. It consists in putting a number of plates into one tank, in which vessel they are held in an upright position, and surrounded with a weak solution of normal developer, at a certain temperature, which is allowed to act for a certain length of time. At the expiration of the required time for complete development the plates are removed from the tank, and fixed in the usual way.

486. **Latitude in Development.**— There is a wonderful latitude in the time of development with tank developer. A plate may be developed in ten minutes or two hours, producing practically the same results, and this is entirely governed by the strength of the developer employed, and the temperature of the solution, which regulates the time for complete development.

487. To prepare a developer for tank development and a bath that will develop plates in a certain number of minutes, there are different ways of proceeding; one is to take your regular normal developer and dilute with water sufficiently to develop a normally exposed plate in the desired number of minutes. For instance, to dilute the normal pyro developer given for universal developing with double the amount of water, or twice as much water as you have normal developing solution, will give you approximately a twenty-minute developer, and diluting it three times gives a twenty-five-minute developer. (See Par. 467–470.) The accurate time, of course, can only be ascertained by a few trials.

488. One can disregard the exact time entirely, and judge the complete development by examination from time to time. Yet, it is best to handle plates as little as possible while developing, for the warmth from the hands changes the temperature of the solution, thus rendering the film soft, and easily damaged; and again, it is also well to know the exact speed of your developer, as more uniform results can be obtained, especially where all classes of exposure are developed in the same bath, and at the same time.

489. The most successful method to employ, however, is the factorial system, as explained in former instruction, for by means of the factor you can secure the exact time necessary for complete development, and we will, therefore, apply the factorial method for developing in this instruction.

490. For the convenience of those who have followed the developing instruction previously given, we will use our regular pyro formula, given for universal developing, and apply it to tank development.

491. In this instruction for tank development we supply the simplest methods that can be used, and which we have found practical. We would say, however, that to produce perfect negatives by tank development, it requires more than the mechanical work; one must exercise their best judgment, and prepare the chemicals very accurately. We advise applying the formula given herein without alteration until you become more familiar with the working of the bath. Remem-

ber to always keep the temperature as near sixty-five degrees Fahr. as possible.

492. It would be well after becoming familiar with the working of the bath to try a number of experiments, carefully making a memorandum of the strength of the developer, and the time required to fully develop a normal exposed plate. When once you have ascertained the strength of your developer, and the length of time necessary to produce the kind of negative that is best suited to the paper you intend to print on, tank development is then almost a mechanical process.

493. The two formulæ supplied are based on the results obtained by experimenting, and by carefully observing the rules, and properly preparing the developer you will be able to produce good negatives. If, however, your first results are not as you desire, the method of changing the length of time development is extremely simple. The latitude is so great that it will rest entirely with yourself as to the results which you will produce.

494. In a former paragraph we made the statement that a plate might be developed in ten minutes, or in two or more hours, producing the same results. For example: In the former case the developer must be a great deal stronger than in the latter. To make the developer work slower it is only necessary to dilute with water. The weaker the developer the slower will be the process of development. In other words, more or less water will respectively slacken, or increase the speed of development. Usually to dilute a normal developer with an equal amount of water will require a little more than double the time of a normal developer for complete development. We recommend the pyro developer for tank development. However, for those who like the non-staining developers, we give also a metol-hydroquinone formula, and where the latter is employed not longer than a ten to fifteen-minute bath should be used, as long development with metol has a tendency to fog, even with bromide added. The pyro is the most commendable for general results, but should be made up fresh each day, for the action of pyro as a developing agent is such that even in a diluted solution, after a few hours'

standing, whether in use or not, it becomes discolored and loses its developing power, and cannot be relied upon to produce uniform results; therefore, a fresh bath should be made up each day.

495. A pyro bath can be used continually during one day, so long as it produces proper results, and develops in the given time; usually a twenty-minute bath of ninety-six-ounce solution will develop twenty-four 5 x 7 plates before showing signs of weakening. A pyro bath should never be strengthened when it becomes weak but replaced by a fresh bath.

496. The metol-hydroquinone developer can be used continuously for days, for with these agents the action is continuous for a considerable length of time, and only needs renewing when the bath ceases to produce the proper strength, and quality in the given time.

497. The required time for development for either pyro, or metol, is greatly governed by the temperature of the developer, and where the factorial methods are employed the temperature is of the utmost importance. For example: If it requires twenty minutes with the pyro formula to fully develop a plate with the temperature of the developer at sixty-five degrees, it would probably take forty minutes if the temperature were forty-five degrees. This change of temperature changes the time of development, for the warmer the bath the quicker the development is completed, and the colder the bath the slower would be the action of the developer.

498. **Caution.** It is not advisable to depend entirely upon the normal time for developing, especially where all classes of exposures are developed at once, for after a bath is used for some time it is liable to work a trifle slower, but there is one thing you can be certain of, no plate, whether under or over-timed, will be completely developed in less time than those of normal exposures. Therefore, your developer being prepared for a normal exposure, plates of all classes can be placed in the bath at the same time, and when the time for the proper developing of a normal exposed plate is up, all plates can be removed from the bath and examined one at a time, and if any of them lack the required strength, or are not completely

developed, place them back into the tank for further development, and examine again from time to time, and as each plate reaches the proper strength remove to the hypo bath.

499. Bear in mind too that the best negatives are obtained from fully-timed plates, and that you should also endeavor to make all your exposures as even as possible, for where the exposures are very near the same the development will be more accurate. Slow development with pyro is preferable to quick development, as the addition of water to a pyro developer produces finer grained negatives, and the detail and gradation in the highlights and shadows are better.

500. In tank development the plates are placed in a vertical position. This accounts for the fact that the developer accomplishes a quicker and more even action. By this we do not mean that it develops quicker, but the action of development sets in quicker, and more evenly than if the plates were placed in a horizontal position; and it, of course, also overcomes the necessity of rocking the trays or agitating the developer, for this agitation of the developer, unless done gently, causes harshness and a coarse grain. The tank developing is uniformly even, without a tendency to double the tones, producing negatives that are clear, with fine highlights and remarkably fine grain.

501. If you are in the habit of developing a large number of plates at a time, you will find a developing tank or stand method a great time saver, for after loading the tank and taking the time, you can be working at something else until the plates are ready for fixing. In order to make certain that you do not forget the time, an ordinary alarm clock can be brought into use by simply setting the alarm at the time plates should be developed. When the alarm rings take out the plates and place them in the fixing bath, and if you have more plates to develop fill up the tank and again set the alarm. Where a large amount of developing is done more than one tank can be used.

502. The principal requirements for successful developing with the tank method is to ascertain the proper strength of the developer, which will develop the plates completely in a

certain length of time. This can only be obtained accurately by the factorial method, as explained in previous instruction, always bearing in mind that the time of appearance is also governed by the temperature of the developer. The temperature, therefore, should be as uniform as possible.

503. We give below two formulæ, the pyro is a twenty-minute developer, and the metol-hydroquinone will develop in twelve minutes, which time, however, can be shortened or lengthened by strengthening or reducing the developing solution. The stock solution prepared for this pyro formula is exactly the same as that given in formula for universal developer, and the same proportions are used, only we dilute the solution twice that of the normal bath. That is, we add three times as much water as we have bulk of solution in the normal bath.

504. **Formula for Developer.**—Pyro Stock Solution No. 1.

| | |
|---|---|
| Water | 6 ounces. |
| Sulphuric Acid | 1 dram. |
| Pyro | 1 ounce. |

Stock Solution No. 2.

In a 36-oz. bottle pour 2 ozs. Stock Solution No. 1, and add thereto 32 ozs. water.

Stock Solution No. 3.

Sulphite of Soda ( Anhydrous ), 40 hydrometer test, or if by weight,

| | |
|---|---|
| Sulphite of Soda ( Anhydrous ) | 1 ounce. |
| Water | 13 ounces. |

If crystal sodas are used it will be necessary to use two ounces, as anhydrous is twice as strong as the crystals.

For uniform results we would advise that the solutions be prepared by hydrometer test.

Stock Solution, No. 4.

Carbonate of Soda, 20 hydrometer test, or if by weight,

| | |
|---|---|
| Carbonate of Soda (Anhydrous) | 1 ounce |
| Water | 23 ounces |

If crystal sodas are used, two ounces of carbonate will be necessary. We would advise that this solution also be prepared by hydrometer test.

505. **Directions for Use.**— Take sixteen ounces Stock Solution No. 2, eight ounces Stock Solution, No. 3, and eight ounces Stock Solution, No. 4, making thirty-two ounces of Stock Solution. To this add twice as much water as you have solution, or sixty-four ounces water, making ninety-six ounces of bath. If you have a smaller tank you will require less solution, and if more solution is required to fill your developing tank, increase the quantity, but always keep the proportions the same. This solution will fully develop normal exposures in twenty minutes.

506. Figuring by the factorial method, we find the factor for this developer to be forty, and time for development twenty minutes. We would obtain the factor for this bath in the following manner: We have used sixteen ounces of Pyro Stock Solution, No. 2, containing five grains of pyro to the ounce, the sixteen ounces contain eighty grains. To this sixteen ounces of Pyro Solution, add eight ounces of No. 3, and eight ounces of No. 4, making a total of thirty-two ounces of developer. By adding sixty-four ounces of water to this, making a total of ninety-six ounces of solution, we have diluted this normal bath exactly twice. We now have eighty grains of pyro in the ninety-six ounces of solution, or five-sixths of a grain pyro to the ounce of solution. We found the image on a normally exposed plate to appear in this developer, with the solution at sixty-five degrees Fahr., in thirty seconds, and the development was completed in about twelve hundred seconds, or twenty minutes. The factor for this developer, therefore, is one-thirtieth of twelve hundred, or forty, and a plate developed in this strength bath, and at the same temperature, will develop in twenty minutes. In case of plates being very much over-exposed, in order to obtain the proper snap and contrast between highlights and shadows, you may need carry the developing farther. It may perhaps require twenty-five minutes to produce the proper strength; then, after fixing, if they are a little too heavy, reduce them with red prussiate reducer, according to the formula in Instruction on REDUCING. As the red prussiate reduces the highlights and shadows alike, the plate when reduced will

be soft, yet have proper contrast between highlights and shadows.

507. Slightly over-exposed plates will develop in the normal time. Under-exposures will usually develop in the same period of time as normal exposures, and ordinarily such exposures will develop better with tank development than by developing in the tray, because the weaker developing solution allows the developing agent to thoroughly penetrate the emulsion, and work up shadow detail, where a very quick acting developer tends to surface development, and the strongest lights have become opaque before the emulsion is sufficiently softened to allow of the required amount of action on the shadows or under-exposed portions. In case of extreme under-exposure a more diluted bath is still better and will produce better results, but will require more time to complete the development.

PROPORTIONS FOR DIFFERENT SIZE TANKS.

For a forty-eight-ounce tank, use the following: —

| | |
|---|---|
| No. 2 | 8 ounces. |
| No. 3 | 4 ounces. |
| No. 4 | 4 ounces. |
| Water | 32 ounces. |

For a twenty-four-ounce tank, use: —

| | |
|---|---|
| No. 2 | 4 ounces. |
| No. 3 | 2 ounces. |
| No. 4 | 2 ounces. |
| Water | 16 ounces. |

508. The temperature of the developer should never be below sixty degrees or higher than seventy degrees Fahr., sixty-five degrees being normal. In some localities the water may be such that you will find it necessary to add more or less water with the same amount of Stock Solution, in order to develop in the given time. This is only in extreme cases, and should it occur, and if the factorial method for tank development is employed, it will not matter whether the water used is strongly alkali or even acid, for the factor for the developer employed remains the same, only the time of

appearance is changed, and all that will be required under such conditions is to know the time of appearance, and multiply by the factor, which will give you the exact time required for complete development, and all plates developed with the same water conditions thereafter will be fully developed in the same time. A little experimenting, and carefully keeping a memorandum of your results, will soon enable you to regulate the speed of the developer.

### METOL-HYDROQUINONE DEVELOPER.

STOCK SOLUTION.

| | | |
|---|---|---|
| Water | 24 | ounces. |
| Metol | 15 | grains. |
| Sulphite of Soda (Anhydrous) | 1¼ | ounces. |
| Hydroquinone | 1 | dram. |
| Bromide of Potassium | 4 | grains. |
| Carbonate of Soda (Anhydrous) | 5 | drams. |

If crystal sodas are used in place of anhydrous, use double the quantity given in the formula, as the anhydrous is twice as strong.

509. **Directions for Use.**—For a twelve-minute developer this metol-hydroquinone formula must be diluted as follows: To every ounce of the developer add four ounces of water. If it is necessary to have twenty-five ounces of solution to fill the tank, take five ounces of the developer and add twenty ounces of water. If more solution is necessary to fill the tank increase the quantity by adding more developer and water, but always keep the proportions the same, and the temperature of the developer should never be under sixty degrees, or above seventy degrees Fahr. This bath will fully develop a plate in from ten to twelve minutes.

510. **The Film Developing Holder.**—The individual films are taken from the film pack, and a film placed in the holder. The holder is then inserted in the developing tank in exactly the same manner as the plate, and development proceeds accordingly. These holders are made in all the popular sizes, and as they list at a very reasonable price there is no reason why this very convenient accessory should not be in the hands of every user of the film pack.

## DEVELOPING TANKS.

511. **Description of Developing Tank.**—These tanks are generally made of brass, nickel plated or zinc, strongly built, and with little care will last many years. The following illustrations are of the Ingento developing tank: Each tank is supplied with a grooved rack. The rack is arranged for different size plates, and is made to fit inside of the tank, and can be raised or lowered in the bath. In this way the plates can be examined while developing, without placing the fingers in the developer. The tanks are made in five sizes, as follows:—

No. 1, for six 3¼ x 4¼ plates, or twelve if placed back to back.

No. 2, for six 4 x 5 plates, or twelve if placed back to back.

No. 3, for six 5 x 7 plates, or twelve if placed back to back.

No. 4, for six 6½ x 8½ plates, or twelve if placed back to back.

No. 5, for six 8 x 10 plates, or twelve if placed back to back.

Tanks Nos. 1 and 2 require only twenty-eight ounces of developer; larger sizes a proportionate amount.

512. **Style "A" Developing Tank.**—In illustration No. 15, we show the developing tank ready to receive the developer. These tanks are made in two grades. Style *A* is strongly made of brass, nickel plated, and fitted with a removable rack, with wide grooves to hold the plates separate and in a vertical position. Tanks of this style can be used for developing, fixing and washing. The developer can be poured off and sufficient hypo solution poured in to fill the tank. After the plates are fixed, the hypo solution can be poured off, and the tank then used as a washing box, by allowing the water to enter through the funnel. In this way the water will thoroughly eliminate the hypo from negatives and tank simultaneously. Additional new sizes of style *A* developing tank are made as follows: 3¼ x 5½ and 4¼ x 6½.

513. **Style "B" Developing Tank.**—The style *B*, see illustration No. 16, is made of heavy zinc, fitted with wide grooves which extend from the top downwards, and with the patent lifting bottom, which allows the negatives to be removed without dipping the fingers in the solution. The style *B* tank can be used for washing, as well as developing, in the

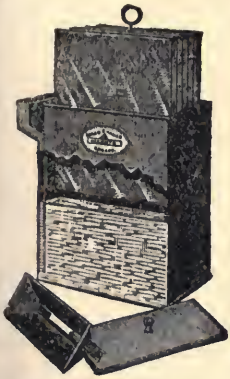

Illustration No. 14
Improved Developing
Tank

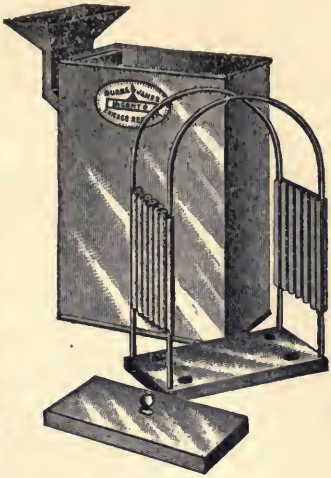

Illustration No. 16
Style B. Developing Tank
See Paragraph No. 513

Illustration No. 15
Style A. Developing Tank
See Paragraph No. 512

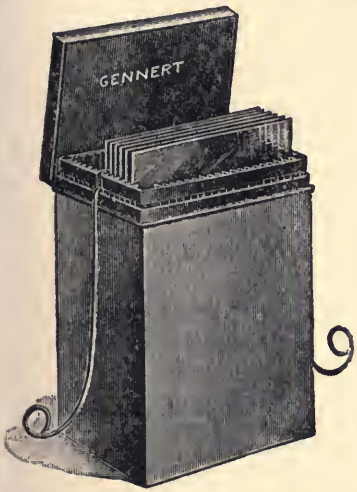


Illustration No. 17
The Gennert Tank

Illustration No. 19
Rubber Fixing Tank
See Paragraph No. 515


Illustration No. 18
The Ideal Fixing Tank
See Paragraph No. 514

Illustration No. 20
Ideal Adjustable Washing Box
See Paragraph No. 516

same way as described in style *A*, but *cannot* be used for fixing, as zinc will gradually disentegrate under the action of a hypo solution. Where style *B* is used an extra fixing tank must be employed.

514. **Fixing Tank.**—The Ideal Fixing Tank is made of heavy tin, with deep corrugations, thoroughly enameled with acid-proof varnish. It is equipped with a patent lifting bottom, and is both convenient and practical. Its capacity is twelve plates. (See Illustration No. 18.) The Ideal, Jr., Fixing Box is made on the same plans, but has a capacity of only six plates, instead of twelve.

515. **Rubber Fixing Box.**—The most reliable fixing box is the hard rubber, see illustration No. 19. They are made of the same material as the rubber trays, and are very durable, and are not affected by any chemicals used. In fact, with reasonable care they will last a lifetime.

516. **Washing Box.**—The Ideal Adjustable Washing Box, see illustration No. 20, is the most practical plate washing box on the market. The water enters at the bottom and overflows at the top. It is supplied with patent raising bottom, and is adjustable for small sizes.

## PRACTICE WORK.

517. **Developing.**—When you are ready to develop, first prepare enough solution to completely cover the plates. After the developer has been prepared test it for temperature, using an ordinary thermometer for the purpose. If you find it too cold add a little hot water (the slight addition of water will make no difference in time of development), or if it is too warm put it in a cold place, or add a small piece of ice, until the temperature is correct. Next light your dark room lamp, close the door, and transfer the exposed plates to the grooved rack; then carefully lower the rack containing the plates into the tank. Lower the plates until they are completely covered with developer, raise the rack slowly two or three times, lifting the plates almost entirely out of the developer. This will remove any air-bells that may have gathered on the plates. These air-bells, if not removed, would cause pin holes or spots.

SAND DUNE

The plates are raised or lowered by means of a wire rod attached to the center of the rack, by catching hold of the ring at the top of rod, thus you avoid wetting the hands in the developer. After all air-bells are removed lower the rack and close the cover on the tank, and also on the funnel. Take the time and allow them to develop for, say five minutes when the plates should be turned end for end, thus insuring even development and allow the development to continue for the total time of twelve minutes, if the metol formula is used; and for twenty minutes if pyro formula is used; then fix in the usual way.

518. Until you have become thoroughly accustomed to this method, and are certain as to the strength of your developer and the time required to develop, it is advisable to examine the plates before fixing. It is, however, only necessary to examine the plates at intervals. After you thoroughly understand the speed of your developer and you have been careful in supplying the proper proportions of each chemical, and your plates are uniformly exposed, it will not be necessary to examine the plates at all until they are completely developed.

519. We would caution you against examining plates too often during development, especially Orthochromatic plates, as even the ruby light is apt to effect them, and the result will be foggy negatives. At the expiration of the time required for the development of normal exposures, examine each plate before you place it in your fixing tank. See that they are fully developed and make due allowance for the density they will lose in the fixing. Before placing them in the hypo, carefully rinse them in clear water. If some of the plates, upon examination, are not fully developed, after you have removed those which are developed, simply lower the rack containing these plates back into the tank, and continue developing. Usually when one plate is developed all are done. It is only in extreme cases that it would be otherwise, and then usually from an over-worked bath.

520. If you have a batch of twenty-four negatives to develop, and your tank has twelve grooves, you can place the plates back to back, putting two plates in this way in each

groove. This will enable you to develop the twenty-four plates at one and the same time.

521. While it is safer to develop and fix in separate tanks, one and the same tank can be used, if necessary, providing the tank is made of some material which will not rust, such as nickled copper or hard rubber. This method is not recommended, however, as there is danger of one becoming careless and not thoroughly cleansing the tank before and after fixing. In case you must use one tank for both, an ordinary rubber fixing box thoroughly cleansed free of all hypo can be used as a developing tank. One advantage of developing and fixing in the same tank is that there is less handling of plates than when fixing and developing in separate tanks. However, this is of little account. Never fix in a tin or iron tank. If you desire to develop and fix in one and the same tank, observe the following:—

522. After the plates are fully developed, pour off the developer into a large bottle, and save for the next developing; then rinse the plates in three changes of water. This you can do by filling up the developing tank with fresh water, pouring off the water and repeating the operation three times. After the last change of water fill the developing tank with hypo solution, and allow the plates to remain in this until they are thoroughly fixed. Next transfer them to the washing tank and carefully wash.

## ADDITIONAL FORMULAE FOR SLOW TANK DEVELOPMENT.

523. With the following formula there is little or no danger of fog from long development if the tank is covered, excluding all light:—

METOL-HYDROQUINONE TANK DEVELOPER NO. 2.

| | | |
|---|---|---|
| Metol | 4 | grains |
| Hydroquinone | 4 | grains |
| Sulphite of Soda (anhydrous) | ¾ | ounce |
| Carbonate of Soda (anhydrous) | ½ | ounce |
| Water | 64 | ounces |

If crystal sodas are used, use twice the amount.

524. Unquestionably one of the best developers for long development, and one which will not fog, is glycine. This developer is prepared slightly different than when used for tray development. This is especially noted for the reason that if the ordinary glycine formula is used for many plates it will sometimes impart a yellowish tinge to the negative This is overcome in this formula by using *not more than* equal weight of sulphite to glycine, when preparing the solution.

GLYCINE FORMULA FOR TANK DEVELOPMENT NO. 3.

| | |
|---|---|
| Water (hot) | 7 ounces |
| Sulphite of Soda (anhydrous) | 30 grains |
| Carbonate of Soda (anhydrous) | 30 grains |
| Glycine | 30 grains |

After the above have been dissolved add water, twenty-eight ounces.

NOTE.— If crystal sodas are used, employ double the weight, or sixty grains in place of thirty grains.

525. In using any of the above developers in the tank it is advisable that the temperature be not more than sixty degrees Fahr., in order to obtain the best results. If the weather is very warm the tank should be placed in a vessel containing very cold water for a time, and in cold weather, when it is very cold, the tank should be placed in a vessel containing warm water, thus equalizing the temperature. These formulæ for long development are not as reliable for exact time for complete development, but as there is so much latitude, by occasional examination the best results can be obtained from any exposure. For instance, if a normal exposure would develop in thirty minutes a very much under-timed plate could develop for an hour, or even all day, and improve with time. So when using the above formula, it is advisable to examine each plate in the tank before removing, and if any are not perfectly developed place them back into the tank until fully developed.

When using glycine developer special care should be exercised that no trace of hypo is conveyed to the developer or

yellow stains will surely follow. For fixing use the regular acid-fixing bath.

### ACID-FIXING BATH.

526. The plain fixing bath has the disadvantage of becoming dark and discolored when organic developers are used, and consequently, it is liable to stain the plate. This is overcome by using the acid-fixing bath according to the following formula :—

| | |
|---|---|
| Water | 80 ounces |
| Hypo | 4 ounces |

Dissolve, and then add citric acid 1¼ ounces. After this has been dissolved add hypo 16 ounces. When the ingredients are all dissolved the bath is ready for use, and plates should be fixed at least ten minutes after all the free silver or milky appearance has been removed.

527. **Life of the Developing Solutions.**— The pyro developer should only be used for one day's developing. The metol-hydroquinone developer can be used repeatedly, so long as it gives good results. You must, however, make due allowance for the fact that each lot of plates is adding bromide to the developer, the bromide being eliminated from the emulsion of the plates previously developed. The developer dissolves the bromide in the plate, and it therefore becomes a part of the solution and will retard the development. This will especially be noticed after the bath has been used for some time, and with short factor developers will tend to materially alter the factor. Carefully watch your negatives and when you find that the developer is acting slow or developing contrasty — in other words, when the bath fails to produce the proper results, make up a new one. Always keep the bath covered, excluding all light, whether in use or not.

528. If you are using a zinc developing tank, carefully rinse it after you are through developing and turn it bottom side up so that it will become dry. A little care will enable you to preserve this tank for years.

529. **Practice Work.**—In preparing the lesson on tank development first provide yourself with a tank holding six 5x7 plates, or their equivalent. Next make a few exposures, which you know to be normally exposed, then prepare enough of the pyro developer to make solution sufficient to fill your tank. If a small tank, twenty-eight ounces will be sufficient. If the developer was made according to formula, you can be certain that the plates will be developed in twenty minutes; but you should prove the accuracy of this and for the benefit of your own experience make a practical test. By watching the plate carefully from the moment it enters the developer, and noting the time of appearance of the strongest light with general outlines slightly visible (which should be thirty seconds), see how near your judgment was right; then, the next step is to examine the plates at the expiration of twenty minutes and see if in your judgment the plate is completely developed. This will supply you excellent practice and will train you in the accurate judgment of the correct development of the plate under all conditions. After each experiment dry the negative and make good solid proof prints, untoned, from the plate, and note the quality of the proofs produced. Make notes on the back of each proof, naming the formula employed, which in this case would be pyro, the time for complete development, and any other data concerning the development of that plate. Note also whether the plate was normal, over or under-exposed. File these proofs in your letter-file for future reference.

530. After trying out the pyro formula prepare the metol-hydroquinone formula, and observe the results in the same manner, making proof prints in every instance, and filing the same with all data connected with the producing of the results. This data will be for your future guidance. After completing your experiments compare the results and judge for yourself which formula you prefer to use regularly; and by this time, if you so desire, you may try altering the formula, which is good practice, and will only have the effect of making you more proficient in your judgment.

If you meet with any failures make use of the Index, and refer to the Difficulty Department, where you will undoubtedly find a prevention or remedy for your difficulty.

## DIFFICULTIES—TANK DEVELOPING.

531. **Plates Developing Too Slowly.**—If the plate develops too slowly it is either because the developer has been diluted too much, it is too cold, or it has become exhausted by long use. Carefully test the temperature and if this is correct your bath has become exhausted, therefore, make up a fresh bath exactly according to formula. With a fresh bath made according to formula slow development will not occur.

532. **Plates Develop Too Fast.**—If the developer is too strong, or too warm, the plates will develop too fast. *Remedy:* obvious.

533. **Plates Develop Unevenly.**—If the developer is not thoroughly mixed, the plates will develop unevenly. When adding water to make up the bulk of developer thoroughly stir the solution to insure proper mixing. It is well to occasionally shake the tank during development.

534. **Plates Develop in Streaks.**—If the developer is too strong, and develops too quickly, the plates are apt to develop in streaks. Dilute the developer by adding more water and mix well. It is not advisable to use a faster bath than twenty minutes for pyro, or ten minutes for metol. Always shake a bath well before admitting the plates.

535. **Pin Holes.**—When the plates are first immersed in the developer air-bells are apt to gather on the surface of the plate, and if these are not removed will cause pin holes and transparent spots. When first placing the plates in the tank raise and lower them two or three times very carefully; this will remove the air-bells. Sometimes air in the water will

cause air-bells; to use cold boiled water will overcome this difficulty.

536. **Spots and Pin Holes on Plates That Are not Caused by Air-Bells.**—These are sometimes caused by particles of dirt in the developer. Always filter old developer before using.

537. **Negatives Contrasty**—If the plates are properly exposed this can only occur when the developer is not properly balanced, and there is too much of the developing agent in the developer. Even diluting with water will not overcome this, and it clearly shows that you must have made a mistake in the quantity of developing agent used. It will be advisable for you to make up a fresh bath. An excess amount of bromide will also give similar results. An over-worked bath also contains considerable bromide, eliminated from plates previously developed.

538. **Negatives Develop Flat.**—Either the plates are badly over-exposed or the developer is weak in developing agent. Possibly the stock solution which contains the developing agent was not correctly prepared, not enough of the developing agent added. Where long factor developing is resorted to (using weak solutions), the image, during the first three-fourths of the period of development, is flat, the contrast gaining rapidly at the latter end. Developing longer will give you stronger negatives, but you will likely find your trouble was in preparing your developer.

539. **Negatives Full of Detail, But Very Thin.**—The plates were either over-exposed or under-developed, or both. It is advisable to carry plates which appear flat and are over-exposed, farther in the developing. If they are then too dense reduce them according to instructions given in REDUCING. With a bath in good condition, and the proper time given for development, you should obtain good negatives. Be sure you make no mistake in the time.

540. **Negatives Too Yellow When Developed in the Pyro Developer.**—When this occurs it signifies that the sulphite is not strong enough, or the sulphite solution is old, and has deteriorated. We would advise that you prepare a

new stock solution of sulphite, being careful that it is made the proper strength. The color of the plate is controlled entirely by the strength of the sulphite. It requires a certain amount of sulphite to give you the right color, and to balance the developer.

NOTE.—If crystal sodas are used in place of anhydrous you will require twice the amount.

541. **Negatives Too Blue.**—As the sulphite controls the color of the negative, blue or gray negatives would signify that the sulphite stock solution is too strong. Carefully test it, and if too strong dilute with water, and try it again, until the desired result in proper color is obtained. Your carbonate may also be weak or impure, but if the negative is right in every other respect but color, then your sulphite *alone* is at fault.

542. **When Developing with Pyro Plates Develop to a Certain Stage and Then Stop.**—This will only occur when the developer is too weak or is over-worked, and the developing agent has become exhausted. Pyro in solution deteriorates quite rapidly; therefore it is liable to work slow after a few hours' use, especially in warm weather or hot climates. Do not over-work the bath in a warm climate. Not more than twenty-four to thirty 5 x 7 plates should be developed in a one hundred ounce bath. After developing this number of plates the bath better be discarded.

543. **Plates Developing Contrasty in Hydro-Metol Developer After the Bath Has Been Used for Some Time.**—This is caused by the bromide which was released from the plates previously developed, and which, when dissolving, became a part of the developer, thereby restraining the development. A bath in this condition is unreliable and a new one should be prepared.

544. **Top Edges of Plates Not Developed.**—This will occur if there is not sufficient developer in the tank to completely cover the plate.

545. **Some Plates Develop Quicker Than Others.**—This will occur when the exposures vary. Carefully examine plates just before placing in hypo. Those that are not fully

developed return to the developing tank, and prolong the development. Ordinarily a slightly under-exposed plate and a normal exposed one will be completely developed at the same time, but invariably an over-exposure will require a little longer developing, and possibly reducing afterwards.

546. **Scum Gathering on the Developer While in the Tank.**—This is apt to happen if the tank is left uncovered for a considerable length of time, and is caused by oxidization. This scum will do no harm if the bath is stirred up, and if the plates are raised and lowered two or three times when placed in the developer. Should you fail to do this the scum will settle on the plate and cause transparent spots, stains and uneven development. The safest way is to keep the tank covered always, and when sediment or scum collects filter before using.

547. **Sediment Gathering in the Developing Tank and Bottle Which Contains Hydro-Metol Developer.**—This is a precipitation which will occur, but will do no harm and have no injurious effect in the development.

548. **Testing Development for Temperature.**—This is a very simple matter. Provide yourself with an all glass dairy or bath thermometer, which can be purchased very cheaply. After you have diluted the developer place the thermometer in it. If too cold, add a little hot water. The extra water will make very little difference in diluting the developer. If too warm, add a small piece of ice or a few ounces of very cold water until you have produced the correct temperature; or place the tank in a tray of ice water.

## CHAPTER XX.

# TANK DEVELOPING FOR THE PROFESSIONAL.

1909 Addition.

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### DOMINANT PRINCIPLES IN TANK DEVELOPMENT.

*The effect of light values in the studio as pertaining to correct tank developing.*

To insure the best possible results by this system of development, many principles must be closely adhered to which are frequently overlooked or, at least, neglected. *The most important considerations are temperature, strength of chemicals, and the chemical properties of the light used in making the exposure and their relation to the proper time of development.* The writer's experience has been that when the light used in making the exposure is in large volume its effect in the development is equivalent to that produced by an alkali, and there is an excess of detail and slower building power. Under such conditions of light the best results are obtained when the quantity of stock chemicals used are doubled and the time of development necessary in obtaining proper density is reduced, when much more brilliancy will be obtained. On the other hand, when the light is narrow and used more concentrated rather than in large volume the same relation of balance does not exist between high-lights and shadows, and the slower action of the chemicals (resulting from a more diluted solution,

which requires longer time for development) usually gives best results.

From the above it will be seen readily that in addition to time and temperature due attention must also be given to the *light conditions* under which the exposures are made. Thus, the more closely the individual problem of the photographer is adhered to, and conditions of chemicals, temperature, chemical properties of light and its effect upon the time it will take with a given strength of chemicals to obtain the proper density, just so satisfactorily will results be obtained.

The fact that in one studio where a large volume of light is employed when making the exposure, a developer (prepared with two ounces each of the different stock solutions with a given amount of water added, and the temperature of the solution of 65° Fahr.) should develop in twenty minutes and give excellent results does not mean that the same results would be obtained under different conditions in another studio where a more concentrated or a different actinic value of light was employed in making the exposure. Due to the different chemical properties of light, the same conditions may require 25 to 30 minutes to secure the same quality; so the most careful adaptation to the individual conditions under which one is working yields unquestionably the best results.

**Developing Tanks for the Professional.**—The professional photographer, as a rule, seeks the easiest and simplest methods possible for accomplishing results; therefore, many of them who have adopted tank development employ the regulation rubber fixing tank, with a tight fitting cover, which, if properly handled, answers every purpose. The principal objection to this tank is the possibility of streaks and air-bells. This objection may be overcome, however, by raising and lowering each plate when first placing it in the tank, and then occasionally shaking the latter gently to mix the solution thoroughly.

The regular rubber hypo tank method can be improved

upon by providing a wooden box, made three inches larger each way than your regular hypo tank, painted both inside and outside with shellac, or black mogul varnish, making the box water tight. Then provide a grooved box, similar to the rubber hypo tank, minus the bottom; in other words, provide a rack or cage, properly grooved, into which you can place your plates for developing. Should you have an old rubber hypo tank, which is discarded on account of its being cracked or broken in some particular place, making it unfit for use, take this tank and cut out the bottom to within a half inch of the side walls, and also cut the rim off the top of the rubber tank, thus making of it a cage or rack for holding the plates.

The developer is placed in the large wooden tank, and when ready to develop the rubber rack, or whatever rack you provide for this purpose, is filled with plates and gradually lowered into the developer, and the rack loaded with plates is raised up and down a few times in the solution, to eliminate any air-bells that might collect. With this done the tight fitting cover is placed on the tank and the time taken. After the plates have developed, say for five minutes, the cover is removed and the cage containing the plates is turned on its side. The cover is again put on for another five minutes, when the cage is turned on the other side. In this way even development is obtained. After development the cage may be placed in a hypo tank, made the same as the developing tank, and when fixed the plates may be washed in the usual way.

Note. Should the cage be made of galvanized iron, then the plates must be removed from the cage and fixed in a separate hypo tank, as it would not do to place a galvanized iron rack in hypo. Rubber or nickled-brass cages may be used for both developing and fixing.

**Developers.**—Any of the formulae given in this volume for Tank Development will give satisfactory results. First determine upon the results desired, and then prepare the formula to produce such results. For example, where soft-

ness is desired pyro-metol makes a good combination, for the metol assists in producing detail when one is inclined to under-time. The following formula for acetone-pyro developer, suggested by the Cramer Dry Plate Company, has proven very satisfactory:

**PYRO-ACETONE DEVELOPER.**

No. 1.

| | |
|---|---|
| Water | 16 ozs. |
| Oxalic Acid | 12 grs. |
| Metol | 120 grs. |
| Pyro | 1 oz. |

No. 2.

Sulphite of Soda, 70 hydrometer test.

No. 3.

| | |
|---|---|
| Water | 20 ozs. |
| Acetone | 4 ozs. |

For tank development take 3 ozs. of each of the above solutions, and add 70 ozs. of water at 70° Fahr. A developer made up according to this formula will develop plates to full density in 30 minutes.

*If the pyro-acetone is desired for tray developing take* 1 *oz. each of* 1, 2 *and* 3 *to* 5 *ozs. of water.*

Note: Observe that the acetone is mixed separately from the pyro or sulphite of soda. It has been found, by experience, that these chemicals are more active when prepared in stock solutions separately and mixed together when ready for use. The advantage of the acetone over the carbonate of soda lies in the fact that plates developed with pyro-acetone will *not* streak nor develop *unevenly* in the tank, and it also prevents fog, as plates may be developed with acetone for any length of time without chemical fog. The acetone also prevents *frilling*, and in case of very short exposures a warmer solution may be employed to good advantage, without danger of frilling or chemical fog. It will be important to remember that when *acetone* is used in the developer in place of *soda*, the temperature *must not be below* 65°, for if worked at a lower temperature the acetone becomes inactive. The experience of the writer has demonstrated that at 70° Fahr. the acetone works at its best.

**Developing Short Exposures.**—Since the inauguration of the tank method of developing, which is especially commendable for under-exposures, photographers are becoming somewhat careless in their timing, and are inclined to under-expose most of their work. Owing to this fact the small addition of metol has been added to the pyro formula, which assists in getting out more detail in plates of short exposure. Where full time is given, if one so desires, the metol may be omitted entirely and the formula used as given (minus the metol). Metol has a tendency to give flatness when used on plates fully timed, or but slightly over-exposed; therefore, when one is accustomed to giving full time it is advisable to omit the metol from the formula.

**Fixing Bath.**—While the plain fixing bath prepared with water and hypo may be successfully employed, yet we find in certain localities, which are troubled with organic substances in the water used, causing spots and stains on the film, that the following chrome alum bath has been found more satisfactory:

No. 1.

| | | |
|---|---|---|
| Water | 128 | ozs. |
| Hypo | 2½ | lbs. |
| Or, by hydrometer test | 90 | |

No. 2.

| | | |
|---|---|---|
| Water | 32 | ozs. |
| Sulphite of Soda (Anhydrous) | 3 | ozs. |
| Sulphuric Acid CP | ½ | oz. |
| Powdered Chrome Alum | 2 | ozs. |

Dissolve thoroughly in order given and add No. 2 to No. 1, stirring while adding.

NOTE. The above bath is intended for hot climates or summer months; for cold climates or winter months use half the quantity of No. 2.

**Removing Organic Stains.**—While the above bath will prevent any stains of an organic nature, should you have some plates so stained previous to using the above bath, these stains may be removed by first immersing the plate in water for, say, ten minutes, and then flowing over the

surface a strong solution of citric acid. This will remove all stains and any excess color from the plate.

### DEVELOPING TANKS FOR PROFESSIONAL USE.

Of the different developing tanks manufactured for professional use, we describe a few. Each tank is constructed with the intention of overcoming the usual difficulties met with in tank developing, which are, principally, retaining of even temperature during development, the overcoming of streaks, uneven developing of the plate, and also the prevention of air-bells.

**The Burke & James Style C Tank.**—With this style of tank, if desired, the plates may be developed and fixed in the same tank. The exposed plates are put into the plate rack, which, in turn, is placed into an inner tank. This part is done in the dark-room. The cover being securely fastened, the light may be turned on, the door of the dark-room may be opened, or the tank may even be brought into broad daylight. The inner tank is then lowered into the outer tank containing the developing solution, and left for half the developing period, when the inner tank is withdrawn and reversed. The reversing of the plates insures uniformity of development.

A light-tight opening in the bottom of the inner tank admits the developer, and an opening at the top allows the air to escape, permitting the tank to fill rapidly. The tank being made of brass, nickel-plated, it can, if desired, be used for fixing as well as developing. (See Illustration No. 21.)

**Eagle Developing Tank.**—The Eagle Adjustable Tank is made in two styles, zinc and nickel-plated. The zinc is intended for developing only, as the fixing bath would be affected by the zinc. The nickel-plated tank can be used for developing, fixing and washing.

The plates are loaded in the rack and then placed in the tank containing the solution, the cover being placed on the tank, and the plates are then on their way develop-

Illustration No. 21.
B. & J. Developing Tank.
Style C.
See Page No. 224*f*.

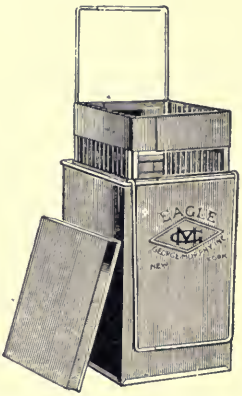


Illustration No. 22.
Eagle Developing Tank.
See Page 224*i*.

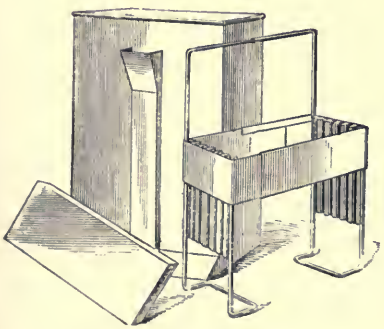

Illustration No. 23.
Eagle Developing Tank.
See Page 224*i*.

Illustration No. 24.
Lowering Rack of Plates Into Solution Cup.

See Page No. 224*i*.

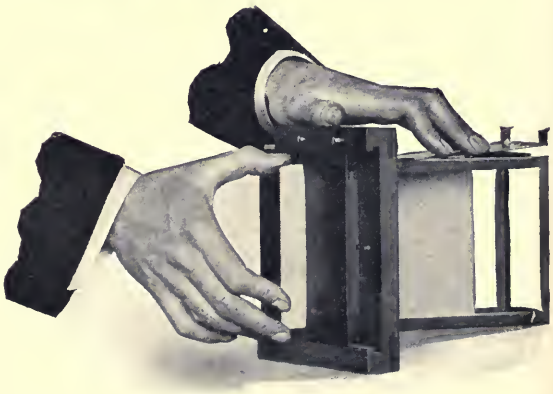

Illustration No. 25.
Loading Plate Into Rack.

See Page 224*i*.

EASTMAN DEVELOPING TANK

ing. As the cover fits tightly the tank can be turned upside down a few times during developing, thus insuring even development. When the plates are developed they may be removed to the regular fixing tank; or, if the nickel-plated tank is used, and when so desired, the developer may be poured off and sufficient hypo solution (hypo, 1 oz., water, 4 ozs.) to cover the plates poured in. When properly fixed, pour off the fixing solution and wash the plates by allowing the water from the tap to flow through the funnel. This method removes the hypo from both plates and tank at the same time.

The professional sizes of these tanks are known as the Nos. 11 and 12. The No. 11 will hold 48 5x7 size, or smaller; the No. 12 will hold 24 8x10 size, or smaller. The professional sizes are made with a handle, which, when the rack is lifted partly out of the tank, falls over the side and locks, holding the rack up out of the developer. (See Illustrations Nos. 22 and 23.

**Eastman Plate Tank.**—The Eastman developing tank is made in different sizes to accommodate all of the standard sizes of plates. Those recommended for the professional are the 5 x 7 and 8 x 10 sizes. In Volume I of this library we fully illustrate the use of the smaller size tank. The 5 x 7 tank is manipulated in practically the same way, although it is slightly different in construction, and is fitted with a cage for holding twelve 5 x 7 plates, and requires 64 ounces of solution. (See Illustrations Nos. 24 and 25.) The 8 x 10 tank has an adjustable metal cage for the holding of plates from 4¼ x 6½ to 8 x 10, and requires 156 ozs. of solution. (See Illustrations Nos. 26 and 27.)

**Developing Formulae.**—The following Pyro or Glycin formulae will produce good results:

### PYRO FORMULA FOR TANK DEVELOPING.

A

| | |
|---|---|
| Water | 16 ozs. |
| Pyro | 1 oz. |
| Oxalic Acid | 10 grs. |

B

Water ..... 16 ozs.
Eastman's Sulphite of Soda..... 3 ozs.

C

Water ..... 16 ozs.
Eastman's Carbonate of Soda..... 1 oz.

For 5 x 7 tank use—
A ..... 1 oz.
B ..... 1 oz.
C ..... 1 oz.
Water ..... 61 ozs.

For 8 x 10 tank use—
A ..... 2½ ozs.
B ..... 2½ ozs.
C ..... 2½ ozs.
Water ..... To Make up 156 ozs.

NOTE.—If crystal sodas are used take three times the quantity of carbonate and double the quantity of sulphite. With the temperature at 65° Fahr. this formula will develop plates completely in 30 minutes. With the temperature at 70° Fahr. the plates will be fully developed in 25 minutes.

## GLYCIN TANK DEVELOPER.

### Stock Solution.

Hot Water, about 200°..... 60 ozs.
Carbonate of Soda (Eastman's)..... 2 ozs.
Glycin ..... ½ oz.
Sulphite of Soda (Eastman's)..... ½ oz.
Dissolve in the order given.

For the 5 x 7 tank use—
Stock Solution ..... 6 ozs.
Water ..... 58 ozs.

For the 8 x 10 tank use—
Stock Solution ..... 15 ozs.
Water ..... 141 ozs.

With the temperature at 65° Fahr. this developer will completely develop plates in 30 minutes.

## FIXING BATH RECOMMENDED.

### By Weight.

A

Water ..... 96 ozs.
Sulphite of Soda..... 2 ozs.
Hypo ..... 2 lbs.

B

Water ..... 32 ozs.
Chrome Alum..... 2 ozs.
Sulphuric Acid C. P...¼ oz.

### By Hydrometer.

A

Hypo, Test 80..... 100 ozs.
Sulphite of Soda, Test 60 ..... 16 ozs.

B

Chrome Alum, Test 20 ..... 32 ozs.
Sulphuric Acid C. P. 2 dms

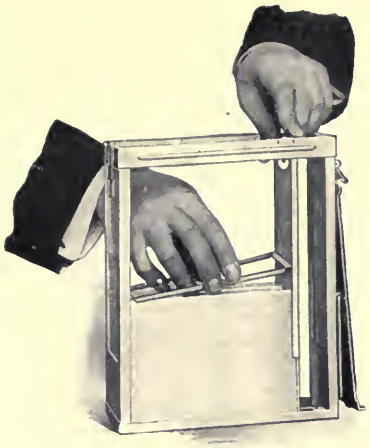

Illustration No. 26.
Placing Septum over Lower Tier of Plates.
See Page No. 224*i*.

Illustration No. 27.
Fastening Cover of Solution Cup.
See Page No. 224*i*.

EASTMAN DEVELOPING TANK.

When dissolved pour *B* into *A*, slowly, while stirring *A* rapidly. This bath may be used continuously so long as it fixes plates in 15 minutes' time.

## USE OF THE EASTMAN PLATE TANK.

By S. G. Lofft, of the Plate Division, Eastman Kodak Co.

With a view to eliminating many of the inconveniences of the ordinary tanks, the Eastman Plate Tank has been designed to meet the requirements of professional and amateur photographers, and is furnished in sizes which may be adapted to all sizes of plates commonly in use up to 8x10.

Some of the leading features in the Eastman tank are, viz: Perfection in construction, durability (being made of brass, nickel-plated, and practically non-corrosive), convenience in loading, complete exclusion of air during development, thus preventing oxidization of developer, maintaining an even temperature, providing for perfect agitation during development, thus securing even development, and, not the least of its advantages is that it enables the photographer to develop with pyro without staining the hands in the least degree.

Each tank is furnished with a carrier or cage, also made of brass, nickeled, holding twelve (12) plates, and a loading device, by means of which plates may be loaded into the cage in absolute darkness if desired. This is a great advantage where orthochromatic plates are in use, as it eliminates the danger of fog while loading and developing.

A hinged cover on the cage secures the plates after loading, and the bail or handle attached to this cover enables one to handle the rack full of plates with facility, and is used to lower cage into tank of developer.

It has been demonstrated that beyond a certain point of dilution, a developer of certain strength and certain temperature will develop a variety of exposures to a proper point in a certain length of time. After a long series of ex-

perimenting, it has been discovered that a developer so compounded as to develop in about 30 minutes will cover the widest range of exposures with the most satisfactory results.

The manufacturers of this tank do not claim for it that it will develop all kinds of exposures exactly alike, but while there will be a difference in density between extremes of over-exposure and under-exposure, this slow method of development will equalize such exposures to a remarkable degreee, and average exposures will be developed with such slight variation in printing quality as to be scarcely perceptible.

It will be noticed in using this tank, that the length of exposures may be reduced materially, as it is a well known fact that dilute developer will produce detail in the shadows without over-developing the higher tones where plates have received a minimum exposure, much better than the stronger developer usually employed in tray development. Successful tank development in a given length of time necessitates care in the selection of chemicals that are of a known uniform strength. As many brands of sulphite of soda on the market contain a great percentage of *sulphate of soda,* and as different makes of carbonate of soda vary greatly in their active alkaline properties, it is recommended that only reliable brands of sodas be used. The accompanying formulae is prepared with Eastman's sodas. Where other sodas are used, it is advised to test their strength by experimental development till it is determined just how much to use to secure the desired strength of development in the time specified.

It is equally important that the temperature be accurately adjusted, as a few degrees one way or another will make a marked difference in the time of development. For instance, a developer that would complete development in 30 minutes at a temperature of 65° would produce approximately the same density in 25 minutes at 70°. A temperature of 65° is, however, as a rule more satisfactory the year around,

as plates do not soften at this point, and the resulting negatives are finer in grain and firmer in texture, as there is no tendency to swell the cells of gelatin beyond a normal degree, as in a higher temperature.

It is important in this connection, that plates be kept in a moderate temperature before and after exposure, as it is obvious that if they are extremely cold, or very warm, they will lower or raise the temperature of the developer, and thus develop slower or more rapidly as the case may be. This, by the way, is important even in tray development, as without doubt the character of negatives is largely influenced by the temperature of the plates themselves.

Within the experience of the writer, one lot of plates developed in the tank in 15 minutes in a normal 30 minute solution, owing to the fact that the plates were kept in a changing room that was exposed to the heat of the sun, and were really warm to the touch. The resulting negatives were rather flat and heavy, and lacking in brilliancy and the delicate gradation that is desirable.

It will thus be seen that temperature plays an important part in tank development, and success cannot be hoped for unless careful attention is given to this detail.

Where several tanks are in use for developing a large number of plates, enough water to fill all the tanks can be brought to the desired temperature; then after adding to the tanks the stock solutions, as given in formula, fill tanks with the tempered water to lower embossed line.

After preparing developer as directed, load plates into the cage, with the aid of the loading block, being careful to place the first plate glass side out, and all the others facing it, thus bringing both outside plates glass side out, to prevent scratching; remove loader, close hinged cover of cage, and with the bail or handle thereon, lower plates slowly and easily into the developer.

Care should be taken not to stop the plates while lowering into the developer.

To remove any chance air-bells, move the cage up and

down half a dozen times after first submerging it without bringing it above the surface of the developer. Clamp the cover on the tank, then take the tank in both hands and reverse rapidly three or four times. This will prevent semi-transparent spots with blended outlines, which are sometimes caused by effervescence in developer or minute particles adhering to the surface of the plate before the film is thoroughly saturated. Then set indicator on dial to point when plates are to be done, thirty minutes ahead of the time the developing begins.

During development, tank should be reversed three or four times to agitate the developer and insure even development, and it will be found that this agitation produces greater brilliancy than if plates remain in one position during the period of development.

After development is completed, the developer should be poured off, and three or four changes of water run into the tank to thoroughly free the negatives from developer; then the cage may be lifted out and placed, with the plates still in it, in the hypo bath, or the plates taken out of the cage and fixed as usual, separately, or the fixing bath may be poured into the tank if desired. If the cage or tank be used for fixing, it should be washed thoroughly, and *dried with a cloth;* otherwise water remaining on the metal may contain some hypo, which will crystalize on evaporation of the water and give trouble.

In warm weather it will be found quite advantageous to fix the plates in the cage, as then they are thoroughly hardened before handling with the warm hands.

Should the tank leak on being reversed, it will probably be found that the rubber lining in the cover is not in place, or that the tank has been curved in at the top from handling, so it does not fit snugly against the rubber band. This can easily be remedied, and prevented with a little care.

A clean lens, always an important factor in securing clear, bright negatives, is particularly important when using tank method of development.

As this slow development gives the value of every particle of light that reaches the plate, so it will emphasize the fog or halation caused by a diffusion of light from a hazy lens, and this will be more noticeable than when plates are developed in stronger solutions.

Probably more negative troubles come from hazy lenses than from any other one source, as there is nothing so neglected by the average photographer as these delicate and important instruments of his profession.

It is not sufficient that the outside surface be wiped off occasionally, but it should be done regularly and carefully, inside as well as outside, as it will be found on examination that there is an accumulated deposit on the inner surface of the lenses, which, acting in a modified way like a ground-glass surface, diffuses light all over the plate during exposure, and produces fog, halation, and flat, gray negatives.

To sum up successful tank development, even with a perfect tank, necessitates care in the selection and character of the chemicals used, regulation of the temperature of plates and developer, and keeping your lenses clean.

CHAPTER XXI.

# SPECIAL INSTRUCTION SUPPLIED BY THE STANDARD AMERICAN MANUFACTURERS FOR THE MANIPULATION OF THEIR DIFFERENT BRANDS OF PLATES.

549. **Introduction.**—Believing it essential that the photographer should be competent to manipulate any of the standard American brands of plates, it is advisable, therefore, that each brand be given careful trial. In order to obtain the very best results one should work each plate under all conditions, and when trying one brand of plate do not attempt to work another until you have mastered the particular plate you are manipulating. After all the different brands have been worked, and you are quite familiar with their manipulation, then you can intelligently determine which is best suited for your particular work.

550. In order to supply the reader with still more valuable information regarding any particular standard American make of plates, we have had the different manufacturers prepare for us special instruction, which they have compiled from the information obtained from their numerous demonstrators, operating in all parts of the country. This special information covers the manipulation of all their different brands of plates, and is supplied under their respective headings, in the following chapters : —

# PART I.

## CRAMER PLATES.

*Special notes treating upon the manipulation of the various brands of Cramer plates, compiled especially for this Library by the Cramer Dry Plate Company.*

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551. A resumé of negative-making methods of manipulation, and the advantages of using special brands for special work.

552. Consider it an axiom that the perfect negative is the result of proper lighting and normal exposure, and that such a plate can only be ruined in the dark room by gross carelessness. Also that no juggling with developers will compensate for carelessness in lighting or exposure. It is self-evident that if there has been no exposure there can be no development of an image, also that if there has been insufficient exposure or hard lighting, satisfactory results cannot be obtained, though if the exposure and lighting have been within the latitude of the plate used, skillful handling of the plate during development will give satisfactory results.

553. Train yourself to be careful, accurate and cleanly, and so reduce probability of error to the minimum. A dry plate is a very delicate and sensitive chemical product, and should be handled so as to eliminate all danger of chemical or light fog. When a shipment is received, store the plates on edge, (to avoid pressure) in a cool dry place, away from strong light, and free from the influence of sewer or illuminating gas. When opening a package, and filling plate holders, keep well away from the dark room light (some brands, notably the Trichromatic should be placed in the holders without any light being used, and in a perfectly dark room).

554. **Filling Holders.**— Dust the plate slowly, and thoroughly with a soft, wide camel's hair brush, and place in the holder with the film side towards the slide of the holder.

Close the holder and the plate is then ready for exposure in the camera. The first plate in an original package is face down, the second face up, the third face down, etc. Be sure before leaving the dark room that no packages of plates are open, and that all holders are closed.

555. **Speed of Plates.**— The Crown and the Instantaneous Isochromatic are the two fastest brands made, and for all practical purposes when used under the same conditions, can be considered as of equal speed, and either of these brands should be used for all rapid exposures.

556. **Exposure.**— Correct exposure, or exposure within the latitude of the plate is of vital importance. Time spent in becoming familiar with your lens, plate, light conditions, lighting of subject, etc., is well employed. We would advise all outdoor workers, and those making interiors, to become familiar with, and constantly use a good exposure table, or exposure meter. Its use will enable you to be more certain of the exposure needed under all light conditions for all subjects, at all times of the day and year, and you will have the satisfaction of bringing home plates that will make good printing negatives.

557. For exposures under the skylight nothing will take the place of experience; money spent on a rapid lens, and time spent in keeping that lens perfectly clean, are both well invested. For cleaning the lens take water three ounces, grain alcohol one ounce, nitric acid three drops. After dusting the lens rub with an old clean cotton cloth wet with this solution, and polish with a dry piece of the same cloth.

558. The light should fall on the sitter at an angle of forty-five degrees, and except for special purposes, there should be no violent contrasts between the lights and shadows. Illuminate the shadows sufficiently to balance the lights, or cut down the volume of light falling on the skylight side of the subject by means of a screen so that the lights will balance the shadows. This, and correct exposure, are the only ways to obtain negatives which will please the great majority of the picture buying public. In making white draperies do not flood them with light if you want detail, nor on the other hand do not

keep their tone so low that there are none of those little crisp highlights which add so much to the quality and beauty of the negative.

559. By study and by test become familiar with the light effects obtainable under different portions of your skylight, bearing in mind that under an open light the nearer the subject is to the side light, the more violent the contrasts, while further away they are less. Learn the difference in exposure needed with the different diaphragms, and with the same diaphragm when making a large head and a full figure.

560. The latitude of Cramer plates is so great that if two seconds were the normal exposure, under certain conditions, an exposure of either one second or of four seconds would yield a satisfactory printing negative, if properly developed. Do not abuse the power this latitude gives, for unless you are willing to vary your treatment of plates with extremes of exposure, you will be disappointed in the results obtained. Strive for an even quality of negatives the year round, and the printer shall rise up and call you blessed.

561. **Development of Normal Exposures.**—If you want a steady quality of negatives you must be able to reproduce identical conditions in your dark room every day, if you cannot, you will not reap the reward you desire if even exposures were made in the field or skylight room. Buy only the best chemicals, keep fresh solutions made with pure water, always test the temperature of the developer by means of a thermometer, using it at a temperature of between sixty-five and seventy degrees Fahr., and maintain this temperature during the whole period of development. Keep your trays, graduates, bottles and dark room clean, provide a proper fixing box and keep it filled with a fresh acid-fixing bath.

562. Accustom yourself to working far away from your dark room light, and to exposing plates during development as little as possible to its influence. Use sufficient solution to keep the plate well covered, and continue the development until the lights are sufficiently intense, and no longer. As soon as a plate shows under-exposure, add to the developer an equal quantity of water which may be somewhat warmer, so

that there may be time for all possible detail to develop before the lights become too dense, your object being to get as soft a printing negative as you can. Continued action of normal developer will unduly emphasize the contrasts by giving abnormal density in the lights before all the shadow detail is out.

563. If the plate is over-exposed, the lights and shadows will appear simultaneously, and the negative will develop flat without contrast, unless a sufficient quantity of a one to ten solution of bromide of potassium is added to the developer, either in the beginning or as soon as over-exposure is noticed, the quantity of bromide solution to be added depending on the degree of over-exposure.

564. A few years ago the G. Cramer Dry Plate Co. put on the market their liquid acetone, and during this time it has earned a well deserved place on the dark room shelf. Acetone is a neutral liquid which replaces the alkali in developing solutions. Combined with sulphite of soda and a developing agent it makes a far more regular working developer than any form of alkaline developer can. As no alkali is used there is less danger of the film softening in warm weather, the false densities common with an alkaline developer are avoided and chemical fog from a developer which is too warm or too strong in alkali entirely absent. Liquid acetone should not be confounded with acetone-sulphite (a dry acid powder), which will not answer the purpose.

565. With the pyro-acetone formula, any temperature between sixty-five and eighty degrees Fahrenheit can be used with perfect safety. For tank development it is ideal, as the temperature need not be watched, though of course the higher temperatures naturally cause more rapid development.

566. With normally exposed plates, and any of our standard normal developers at seventy degrees, development should be completed in from five to eight minutes, depending on the factor of the developing agent used. If it is necessary to develop longer than eight minutes, investigate the quality of the chemicals used, the temperature of your developer and dark room, suspecting especially the quality of your carbon-

ate of soda if using an alkaline developer, and of the quality of your sulphite of soda if using acetone.

567. **The Best Developer.** — We are often asked what is the best developer. This question can only be answered relatively, as it depends on for what purpose the negative is to be used. For instance it would not be advisable to use the same developer for fast focal plane shutter-exposures, and for the development of copies from line drawings. In the first instance all the detail possible is wanted, and in the second, all the contrast. Pyrogallic acid is probably used to a greater extent than all other developing agents combined, as it can be easily modified, which is an advantage, but only in the hands of an experienced operator, and it should be used immediately after mixing. Most other developers have better keeping qualities and can be used repeatedly, but each time a developing solution is used it not only loses some of its activity but it also takes up chemicals from the plates developed, which will make it work slower, and with more contrast, besides making it liable to work injuriously to the plate in other ways. (See note at end of DEVELOPERS.)

568. The best advice that can be given is to adopt some standard Cramer developer for regular work, become familiar with its action under various circumstances, and stick to that formula. When undertaking special work, use one of the formulæ recommended for that purpose, and always keep a ten per cent. solution of bromide of potassium in your dark room for use when needed.

569. **Dry Plate Don'ts.** — Don't blame the plates for fog until you know that your camera, shutter or holders, do not leak or reflect light, that your lens is clean, the interior of the tube and the diaphragms dead black, that your dark room is light tight, your developing light safe, your chemicals fresh and pure and in proper working condition, water pure, trays clean, developer not too warm or too strong, and that it contains sufficient bromide of potassium to make it work clear, and until you know that the plates have been stored on edge, in a cool, dry place, free from fumes of illuminating or other gases, and are not too old.

"THE UP HILL ROAD"

STUDY No. 12, See Page 345 GEO. H. SCHEER, M. D., SHEBOYGAN, WIS.

570. Don't blame the plates for excessive contrast until you know that your lighting is not too harsh, that the exposure is sufficient, your lens clean, that your carbonate of soda is of the best quality, that your developer is not too concentrated or too strong in carbonate of soda, and that your other chemicals are pure and fresh.

571. Don't blame the plates for being thin and weak until you know that you are buying pure carbonate of soda, and using a sufficient quantity of it. That your hydrometer is correct, that you are not over-exposing and under-developing, that you are not lighting too flatly, that you are using your developer strong enough and warm enough, and using enough bromide of potassium to keep it working clear.

572. Don't blame the plates for lack of speed or detail until you know that your skylight and lens are clean, that your shutter works as it should, that your diaphragm is not too small, that your lighting is not too weak or too harsh, that your carbonate of soda is all right, and that your hydrometer is correct, and also that your dark room and developer are not too cold.

573. Don't blame the plates for being yellow and stained until you know that your sulphite of soda is pure, fresh and strong enough, that your hypo bath is fresh and slightly acid, that the developer is fresh and cool, and all the chemicals pure and thoroughly dissolved.

574. Don't blame the plates for softening and frilling until you know that you are using a fresh acid fixing and hardening bath, that the plates have been left in the bath until the plate is hardened way through, that the temperature of the developer and fixing bath were not too warm, and that too much carbonate of soda was not used in the developer.

575. Don't blame the plates for insensitive spots, streaks or blotches until you are sure that your developer is not too old or too dilute, particularly when you are using hydroquinone.

576. Don't blame the plates for spots and lines until you know they are not caused by air-bells, dust, glass splinters (from developing several plates at once), scum on developer,

scale from water pipes, bottles or trays, dry pyro or undissolved chemicals, iron scale in water, dirt in camera or holders, water containing organic matter, or a dirty or too stiff dusting brush.

577. **Standard Formulæ for Cramer Plates :—**

PYRO-ACETONE DEVELOPER.

Works quick and uniform, without frilling; can be used in warm climates without ice, and does *not stain the hands.*

| | | |
|---|---|---|
| *A*.—Pure water | 16 ounces | 640 c.c.m. |
| Oxalic Acid | 12 grains | 1 gram |
| Pyrogallic Acid | 1 ounce | 40 grams |
| *B*.—Pure water | 20 ounces | 600 c.c.m. |
| Cramer's Dry Sulphite Soda | 2 ounces | 60 grams |
| (Or 20 ounces Sulphite Soda solution 48 degrees hydrometer test.) | | |
| Cramer's (Liquid) Acetone | 4 ounces | 120 c.c.m. |

For use take:

| | | |
|---|---|---|
| *A* | 1 ounce | 30 c.c.m. |
| *B* | 2 ounces | 60 c.c.m. |
| Water | 8 to 12 ounces | 240 to 360 c.c.m. |

For Double Coated plates use *A* 1 ounce, *B* 2 ounces, water 18 ounces.

For Tank Development use *A* 1 ounce, *B* 2 ounces, water 30 ounces.

578. PYRO DEVELOPER.

| | | |
|---|---|---|
| *A*.—Pure water | 16 ounces | 640 c.c.m. |
| Oxalic Acid | 12 grains | 1 gram |
| Pyrogallic Acid | 1 ounce | 40 grams |
| *B*.—Pure water | 16 ounces | 640 c.c.m. |
| Cramer's Dry Sulphite Soda. | 2 ounces | 80 grams |

(Which will test 60 degrees by hydrometer.)

If negatives are too yellow use more sulphite, if too gray use less.

| | | |
|---|---|---|
| *C*.—Pure water | 24 ounces | 720 c.c.m. |
| Cramer's Dry Carbonate Soda | 2 ounces | 60 grams |

(Which will test 40 degrees by hydrometer.)

For softer effects use less Carbonate (weaker solution).

*Mix for immediate use in the following proportions.*

| | | | |
|---|---|---|---|
| *A*..... | 1 ounce | *A*..... | 1 part |
| *B*..... | 1 ounce | *B*..... | 1 part |
| *C*.. ..... | 1 ounce | *C* ..... | 1 part |
| *Water..... | 15 ounces | *Water..... | 15 parts |

*The quantity of water may be varied from 10 to 20 ounces, 10 ounces for more contrast and density, 20 ounces for less.

## 579. Ortol Developer.

In One Solution:

| | | |
|---|---|---|
| Pure water..... | 60 ounces | 1800 c.c.m. |
| Ortol ..... | 300 grains | 20 grams |
| Bromide of Potassium..... | 15 grains | 1 gram |
| Cramer's Dry Sulphite Soda.. | 3 ounces | 90 grams |
| *Cramer's Dry Carbonate Soda | 1½ ounces | 45 grams |

For use mix 1 part of this stock solution with water 1 to 2 parts for winter use: water 2 to 4 parts for summer use, according to density desired.

*9 ounces Cramer's (Liquid) Acetone ..... 270 c.c.m. can be substituted for 1½ ounces dry carbonate soda.

## 580. Hydroquinone-Metol Developer.

| | | |
|---|---|---|
| *A*.—Pure water ..... | 25 ounces | 750 c.c.m. |
| Metol ..... | 60 grains | 4 grams |
| Hydroquinone ..... | 60 grains | 4 grams |
| Cramer's Dry Sulphite Soda. | 1 ounce | 30 grams |
| *B**.—Pure water ..... | 25 ounces | 750 c.c.m. |
| Cramer's Dry Carbonate Soda | ½ ounce | 15 grams |

(Which will test 10 degrees by hydrometer.)

For use mix equal parts *A* and *B*.

*Solution *B* can be replaced by an equal quantity of diluted Acetone 1 part Cramer's (Liquid) Acetone. Water 20 parts.

Note.—With fresh developer it may be necessary to add to each ounce 1 drop of a 1 to 10 solution of bromide of potassium, to make it work clear. This developer should not be used too old or too dilute or it is liable to produce peculiar streaks and blotches.

### 581. Hydroquinone-Eikonogen Developer.

| | | | |
|---|---|---|---|
| *A*.—Pure hot water | 60 ounces | 1800 c.c.m. |
| Eikonogen | 1 ounce | 30 grams |
| Hydroquinone | ½ ounce | 15 grams |
| Cramer's Dry Sulphite Soda | 2 ounces | 60 grams |
| *B**.—Pure water | 60 ounces | 1800 c.c.m. |
| Cramer's Dry Carbonate Soda | 5 ounces | 150 grams |

(Which will test 40 degrees by hydrometer.)

For use take: *A* 3 parts. *B** 1 part.

---

*Solution *B* can be replaced by a mixture of Cramer's (Liquid) Acetone 1 part, water 10 parts. A few drops of a 1 to 10 solution of Bromide of Potassium should be added if the developer is quite fresh to make it work clear. Combinations of Eikonogen and Hydroquinone should not be used too old or too dilute as they are liable to produce peculiar streaks and blotches on the negative.

### 582. Pyro-Metol Developer.

| | | |
|---|---|---|
| *A*.—Pure water | 30 ounces | 600 c.c.m. |
| Metol | 1 ounce | 20 grams |
| Oxalic Acid | 24 grains | 1 gram |
| Pyrogallic Acid | ½ ounce | 10 grams |
| *B*.—Pure water | 30 ounces | 600 c.c.m. |
| Cramer's Dry Carbonate Soda | 4 ounces | 80 grams |

(Which will test 64 degrees by hydrometer.)

| | | |
|---|---|---|
| *C*.—Pure water | 30 ounces | 600 c.c.m. |
| Cramer's Dry Carbonate Soda | 4 ounces | 80 grams |

(Which will test 64 degrees by hydrometer.)

For use take:

| | | |
|---|---|---|
| ½ ounce | *A* | 10 c.c.m. |
| ½ ounce | *B* | 10 c.c.m. |
| ½ ounce | *C* | 10 c.c.m. |
| 10 to 15 ounces | water | 200 to 300 c.c.m. |

According to intensity desired.

*A*, *B* and *C* may be mixed together and keep well in one solution which should be diluted for use with from 6 to 10 parts of water.

## 583. Pyro-Metol with Acetone.

Substitute for *B* and *C* the following:

| | | |
|---|---|---|
| Pure water..... | 60 ounces | 1200 c.c.m. |
| Cramer's Dry Sulphite Soda. | 6 ounces | 120 grams |
| Cramer's Liquid Acetone.... | 6 ounces | 120 c.c.m. |

For use take:

| | |
|---|---|
| ½ ounce *A*..... | 15 c.c.m. |
| 1 ounce *B*..... | 30 c.c.m. |
| 10 ounces water..... | 300 c.c.m. |

## 584. Developer for Transparencies.

(Lantern Slides.)

*Hydroquinone and Pyrocatechin.*

| | | |
|---|---|---|
| *A*.—Pure water..... | 32 ounces | 960 c.c.m. |
| Cramer's Dry Sulphite Soda. | 6 ounces | 180 grams |
| Pyrocatechin..... | 240 grains | 16 grams |
| Hydroquinone..... | 240 grains | 16 grams |
| Bromide of Potassium..... | 120 grains | 8 grams |
| *B*.—Water ..... | 32 ounces | 960 c.c.m. |
| Caustic Potash..... | 240 grains | 16 grams |

For use mix equal parts *A* and *B*.

Solution *B* can be replaced by:

| | | |
|---|---|---|
| Water ..... | 20 ounces | 600 c.c.m. |
| Cramer's (Liquid) Acetone.. | 12 ounces | 360 c.c.m. |

## 585. Contrast Developer.

For developing over-exposed plates.

Also useful as an addition to normal developer in case it does not work with sufficient brilliancy for which purpose the addition of a few drops per ounce is sufficient.

| | | |
|---|---|---|
| Pure water..... | 30 ounces | 1500 c.c.m. |
| Cramer's Dry Sulphite Soda. | 1 ounce | 50 grams |
| (Which will test 16 degrees by hydrometer.) | | |
| Edinol, Glycin or Hydroquinone | 100 grains | 10 grams |
| Bromide of Potassium..... | 20 grains | 2 grams |
| Carbonate of Potassium..... | ½ ounce | 25 grams |

Use full strength. This solution can be used repeatedly. As soon as a plate shows over-exposure in the normal developer rinse and place

in the dish containing the contrast developer and develop until sufficiently intense.

### 586. Developer for Line Work.

(Black and White.)

| | | |
|---|---|---|
| Pure water..... | 30 ounces | 900 c.c.m. |
| Cramer's Dry Sulphite Soda. | 2 ounces | 60 grams |
| (Which will test 32 degrees by hydrometer.) | | |
| Edinol, Glycin or Hydroquinone | 150 grains | 10 grams |
| Bromide of Potassium..... | 100 grains | 7 grams |
| Carbonate of Potassium..... | 2½ ounces | 75 grams |
| (Use full strength.) | | |

This developer with Cramer Contrast Plates produces negatives of great intensity and absolute clearness, desirable for copies of pencil sketches, pen drawings, line work, etc.

### 587. Developers for X-Ray Plates.

*Eikonogen-Hydroquinone Developer.*

| | | |
|---|---|---|
| *A*.—Pure hot water ..... | 30 ounces | 900 c.c.m. |
| Eikonogen ..... | ¼ ounce | 7 grams |
| Hydroquinone..... ..... | ½ ounce | 15 grams |
| Cramer's Dry Sulphite Soda. | 1 ounce | 30 grams |
| Bromide of Potassium..... | 15 grains | 1 gram |
| *B*.—Water ..... | 10 ounces | 300 c.c.m. |
| Cramer's Dry Sulphite Soda. | 1 ounce | 30 grams |

For use take:

6 ounces *A* ..... 150 c.c.m.
2 ounces *B*..... 50 c.c.m.

*A* and *B* can be mixed together and used as one solution.

### 588. Pyro-Acetone for X-Ray Plates.

(Very Fine.)

Use the regular *A* and *B* Pyro-Acetone solutions taking:

1 ounce *A*..... 30 c.c.m.
4 ounces *B*..... 120 c.c.m.
2 ounces water..... 60 c.c.m.

Adding thereto 2 to 3 drams (8 to 10 c.c.m.) of a 10 per cent. solution of bromide of potassium.

589. FIXING.

Rinse developed plates thoroughly to avoid carrying developer into the fixing bath and place in the following:

*Acid-Fixing and Hardening Bath.*

| | | |
|---|---|---|
| *A*.—Water (1 gallon)..... | 128 ounces | 4 litres |
| Hypo-Sulphite of Soda..... | 32 ounces | 1 kilo |
| (Which will test about 80 degrees by hydrometer.) | | |
| *B*.—(See note below.) Water.... | 32 ounces | 1 litre |
| Cramer's Dry Sulphite Soda. | 3 ounces | 90 grams |
| (Which will test 45 degrees by hydrometer.) | | |
| Sulphuric Acid C. P..... | ½ ounce | 15 c.c.m. |
| Powdered Chrome Alum.... | 2 ounces | 60 grams |

NOTE.—Be sure to mix solution *B* EXACTLY in given proportion and rotation. Always pour *B* into *A* while stirring well. If this is not done precipitation will take place.

During the cold season one-half the quantity of solution *B* is sufficient for full quantity of solution *A*.

*B* can also be prepared as follows:

| | | |
|---|---|---|
| Water ..... | 32 ounces | 1 litre |
| Potassium Meta bi-sulphite.. | 3 ounces | 90 grams |
| Powdered Chrome Alum.... | 2 ounces | 60 grams |

This bath remains clear after frequent use, does not discolor the negatives, and hardens the film to such a degree that the negatives can be washed in warm water and dried by artificial heat if necessary. They should be left in the bath ten to twenty minutes after the bromide of silver appears to have been dissolved, to insure permanency, freedom from stain, and perfect hardening.

If the bath becomes exhausted by continued use, replace it by a new one.

Plain Fixing Bath.

| | | |
|---|---|---|
| Water ..... | 32 ounces | 1 litre |
| Hypo-Sulphite of Soda..... | 8 ounces | 250 grams |
| (Which will test about 80 degrees by hydrometer.) | | |

Do not use the bath when it is discolored, it must be made fresh each day.

590. **Tank Development.**—Or stand development, is constantly growing in popularity, due to its simplicity and the even quality of its results. There are several precautions which

must be observed with the tank method to be used successfully. The tank should be used for no other purpose. The grooves may be wide enough so that two plates (placed back to back), can be put in each groove, and the plates should not come within one-half inch of the bottom of the tank.

591. A tank of hard rubber provided with a light tight cover is preferable; metal tanks, unless made of copper or brass and heavily nickel plated, should be avoided.

592. When any alkaline developer is used the temperature should be fifty-five degrees Fahrenheit, and never allowed to rise higher than sixty degrees Fahrenheit during the time of development. Always test temperature with a thermometer, as a temperature above sixty degrees is liable to cause uneven development, stain and fog.

593. When using Cramer's (Liquid), Acetone, temperatures up to seventy degrees can be used with perfect safety, as this form of developer is not alkaline. The developer should be thoroughly mixed before putting the plates in the solution. Move each plate up and down quickly several times to break air-bells, and after the plates have been in the tank about five or ten minutes, reverse their position, putting the top of the plate where the bottom was to insure even development, and to avoid streaks. When putting plates into the tank be sure that your hands are free from other chemicals.

594. Negatives made of subjects against white grounds may need finishing by tray development in a strong concentrated developer containing a heavy dose of a ten per cent. solution of bromide of potassium.

595. There is a point beyond which the developer cannot safely be diluted without causing peculiar streaks and blotches (see note *A* at end of DEVELOPERS), stain and fog, due to the solution decomposing before development is complete.

After development, the tank should be thoroughly cleaned to prevent stain.

596. **Tank Developers.**—Any of the Cramer standard alkaline developers can be used for tank developers, by adding to the tray developer made up according to formula given in this article, two to three times its bulk of water, so that it

takes about one-half-hour to develop at a temperature of fifty-five degrees Fahr. Cramer's pyro-acetone developer, as given in this article, can be used by taking one ounce of *A*, two ounces of *B*, and thirty ounces of water.

597. Pyro-Metol-Acetone Developer for Tray or Tank Developer.

| | | |
|---|---|---|
| *A*.—Water | 60 ounces | 2700 c.c.m. |
| Metol | 1 ounce | 45 grams |
| Citric Acid | 10 grains | 1 gram |
| Pyrogallic Acid | 1 ounce | 45 grams |
| Cramer's Dry Sulphite Soda | 4 ounces | 180 grams |
| *B*.—Water | 60 ounces | 2700 c.c.m. |
| Cramer's (Liquid) Acetone. | 6 ounces | 270 c.c.m. |
| For use in tank take: | | For use in tray take: |
| 15 ounces *A* | | 1 ounce *A* |
| 15 ounces *B* | | 1 ounce *B* |
| 200 ounces water | | 5 ounces water |

We do not give the time required to develop plates with any of these formulæ, as some users might consider that the time given was a fixed factor, when it depends entirely upon each user's idea of what is the proper intensity. When the time is once settled, however, it can be depended on to give the same intensity with the same temperature and strength of developer, provided the exposures are the same.

598. Peculiar streaks and blotches in the shape of brush marks, finger marks and insensitive spots, appearing as though the plate had been scrubbed with a dirty or greasy brush, or improperly cleaned, are caused by the uneven action of the developer, if it is too old or too much diluted. This trouble is more liable to occur if hydroquinone is used in connection with eikonogen or metol; and can be prevented by using the developer *more concentrated* or by a *radical* change to a different developer.

599. It is hard for a user of dry plates to believe that this trouble is not the fault of the plate, as its appearance and disappearance is erratic, but the most skeptical can convince themselves by making up a fresh and stronger developer from chemicals of known purity, and which have not deteriorated

by long standing. Then develop more of the same lot of plates, none of which will show any markings.

600. **Different Brands of Cramer Plates and Their Uses.**— Cramer Crown Plates are the most rapid plates made. They work with great softness and shadow detail, which qualities especially recommend them for focal plane shutter-exposures, hand cameras, and all instantaneous work. For large negatives and groups in the studio, and for exposures in a poor light or with slow lenses, they should always be used.

601. Cramer Banner X Plates. — Are very rapid with great latitude, giving quick printing negatives full of detail, which produce brilliant prints with perfect gradation from the highest lights to the deepest shadows. They are the most popular plates for general use in portrait photography.

602. Cramer Blue Label Plates.— Made especially for those who prefer plates with more vigor and slightly less speed than the above.

603. Cramer Anchor Plates, of less speed, giving negatives of great clearness and density. Mostly used for commercial work and copies.

604. These four brands can all be handled under ordinary safe dark room conditions with any of the standard Cramer developing formulæ.

605. Cramer Isochromatic Plates.— The universal use of the Isochromatic plates would be of great help in the universal production of better photographs, as they will always give as good results as can be obtained with ordinary plates, and in the great majority of cases far better results. Thousands of photographers do not realize what Isochromatic plates will do for them, or believe that they are more difficult to manipulate. A fair trial will show what Isochromatic plates will accomplish and prove that they are no more difficult to handle than the ordinary plates.

606. Photographers at present are not concerned with the reproduction of color as color, but with the reproduction of color as black, white, and the intermediate tones of gray, and

as the ordinary dry plate is most sensitive to the ultra violet rays, (these rays being totally invisible to the eye), very sensitive to violet and blue, while almost totally insensitive to green, yellow, orange and red, its reproductions of color are outrageously false, and only put up with at all because we are accustomed to such false renderings.

607. The Isochromatic plates being less sensitive to the ultra violet, violet and blue rays, and more sensitive to green, yellow and orange, give far more truthful reproductions of color, even when used without a screen or ray filter, while a very pale ray filter will entirely eliminate the ultra violet rays, and subdue the action of the violet and blue, giving time for full action of the orange, yellow and green. The use of a ray filter on ordinary plates is of no benefit, as these plates are not color sensitive.

608. Portrait photographers are particularly slow to realize the value of Isochromatic plates in studio work, because they believe there is no advantage in their use without a screen, while the doubled or trebled exposure needed with even a weak screen would make their use impracticable. There are, however, marked advantages in studio use, notably when photographing blondes, blue eyes, colored costumes, and as a help to the more truthful rendering of complexions, due to their sensitiveness to yellow and orange.

609. Their advantages in the field are so great, that if once compared with ordinary plates they will always be used, for they give detail when detail was lacking in foliage and foreground, clouds that will print without reducing or dodging, show distant mountains, invisible on ordinary plates and make prints that show nature's colors translated into their true monochrome values.

610. For commercial work, interior work, and home portraiture the use of Isochromatic plates is indispensable. They show grain in wood and design in colored fabrics, detail in frescoes and colored decorations, and are particularly adapted for copying paintings and showing differences in the values of colored costumes and backgrounds in at home portraiture.

611. The demand for Cramer's Isochromatic plates is steadily growing, due to the increasing knowledge of their advantages. They can be handled in the same way as ordinary plates, except that holders should be filled and developing done further away from the dark room light, unless it is sufficiently subdued. Develop the Isochromatic with any standard formula for Cramer plates.

612. Screens or Ray Filters.—For use with Isochromatic plates for best results, should be adjusted to the plate, and we are now preparing to place on the market screens spectroscopically corrected for these plates. The increase of time needed when a screen is used depends on the strength and quality of color used in the screen, and varies from simply doubling of the time used without a screen up to twenty times as much. Blue prints can be beautifully copied by using an Isochromatic plate, and a deep orange screen which will give a negative (if properly timed) showing white lines on a black ground instead of the weak, flat negative given when ordinary plates are used.

613. Isochromatic plates are made in three speeds, instantaneous, medium and slow.

614. Instantaneous Isochromatic for portraits and all work where a rapid exposure is required. These plates give better color values without the use of a yellow screen than any other plate of the same rapidity. They are fully isochromatic when used with a pale yellow ray filter, which requires only a trifle longer exposure. On account of their high sensitiveness to yellow and artificial light, they are the best plates for *flash-light* exposures.

615. Medium Isochromatic Used Extensively for General Commercial Photography.—In interiors the detail in delicate frescoes and colored decorations, which does not show at all when photographed with regular plates, is brought out clearly.

616. By using these plates in landscape work the different shades of foliage, and the values of the sky and clouds are given far better, while distant objects, even in hazy atmosphere, show more distinctly.

617. RAY FILTERS OR COLOR SCREENS are required only when the full isochromatic effect is wanted.

618. SLOW ISOCHROMATIC.—This plate is the only plate made that is *fully sensitive to yellow and orange color without the use of a yellow screen.* It is especially adapted for copying paintings, and will be found invaluable in commercial work, bringing out the grain of wood and design of fabrics, and giving definition that is very desirable in work for trade catalogues. *Also excellent for cloud effects.*

619. CRAMER'S TRICHROMATIC PLATES.—These plates are sensitive to all colors, including red, and while they do not possess the exceedingly high red and green sensitiveness which characterizes the Paniso plate are yet eminently suited for the three-color (indirect) process when used with their proper filters. For landscape photography in combination with the light ISOS II ray filter their use results in effects which are immeasurably superior to those obtained on any other isochromatic or orthochromatic plate. Having a greater extent of sensitiveness (towards the red) than the Instantaneous Isochromatic their superiority of reproduction in all cases concerned with color is obvious, when we consider that this superiority is simply proportional to the increase or color sensitiveness.

620. Three-color work requires three negatives, one made through a blue or purple screen, one through a green, and one through a red color screen. The adjustment of the screens to the plate governs the amount of stopping out and re-etching needed on the printing blocks; poor screens give blocks that need much of this work, while blocks made from plates exposed through spectroscopically adjusted screens require but little re-etching.

621. Trichromatic plates can also be used with advantage in out-of-door work, with an adjusted screen, and will be found to give exquisite tone values when properly used.

622. As this plate is extremely sensitive to all colors, it should be handled both before and after exposure in the dark, or only examined by means of the Cramer Safe-light which transmits only the extreme red of the spectrum, and to which these plates are not sensitive.

623. Develop Trichromatic plates with any standard Cramer formulæ, using the time and temperature method. Rinse

well and leave the negative in an acid-fixing and hardening bath until entirely fixed.

624. CRAMER'S DOUBLE-COATED NON-HALATION PLATES. —First coated with a slow, and for a second time with a rapid emulsion. Specially made to prevent halation, and hence recommended for photographing *interiors in which strong light entering through the windows has to be contended with, and for landscapes, white draperies and all objects* where there exists a strong contrast between light and shade.

625. Use a rather dilute developer for double-coated plates, so that the development can be prolonged sufficiently to affect the lower film, which will take about double the usual time. Rinse for two minutes, and fix in acid-fixing and hardening bath, leaving them in the bath until entirely fixed, which, owing to the thickness of the film, will take more than double the time of a single coated plate. If the plate is taken from the bath before it is fixed, stain will ensue. Final washing must be thorough.

626. Care should be taken that the temperature of the developer, water used for rinsing, and fixing bath be the same, and that the acid-fixing and hardening bath be fresh and properly made. These precautions will obviate any danger of the upper and lower films separating.

627. The Double-Coated are made in the following brands: — Crown, Banner X and Isochromatic Instantaneous, Medium and Slow.

CRAMER STRIPPING PLATES.—Made in Crown, Banner X, Isochromatic or Contrast Brands.

For photo-mechanical work, and all cases where it is necessary to use a reversed negative or transfer a negative film from its original glass to another support.

628. *Directions for Use.*—The manner of manipulating these plates differs but little from that of the ordinary dry plate, the development, fixing, hardening and washing being the same. But the temperature of the developer should not be higher than sixty or sixty-five degrees Fahrenheit, and a fresh cool acid-fixing and hardening bath should be used. Great care, however, should be taken to prevent an injury to

the surface of the film during these operations, as the introduction of fluids between the glass and film would injure the latter. After the final washing the surface of the plate should be flowed with a mixture composed of one part glycerine and thirty parts water. Cut a piece of gelatine tissue, somewhat larger than the plate, soak this in this solution, and bring it in contact with the wet surface of the film. Air-bells between the film and tissue should be carefully expelled by the use of a soft damp sponge, or a squeegee. The over-lapping ends should now be pasted to the back of the negative with stiff starch paste, and the whole placed in the rack to dry. It may then be flowed with plain collodion. To strip the film, cut through it all around the edge of the plate about one-fourth inch in, and remove it with a steady pull. Any stoppage during this operation will cause marks on the negative and should be avoided. The stripped negatives should be preserved between the leaves of a book. They can be printed from either side.

629. For transferring to another sheet of glass harden the fixed and washed negative for ten minutes in a bath composed of Formalin one ounce, water ten ounces, glycerine one-half ounce, then rinse free from all greasy appearance and dry. Cut through edges of film, and remove from the glass as directed above. Then place the film in a warm solution (about ninety degrees Fahrenheit), composed of hard gelatine one ounce, swelled and then dissolved in fifteen ounces of warm water, with the addition of one ounce of glycerine, until the film is limp, then transfer to the clean sheet of glass and gently remove all air-bells with a soft sponge or squeegee, working from the center of the film.

630. CRAMER X-RAY PLATES, are specially made by the Cramer Co. for making X-Ray negatives.

631. While any ordinary plate is of course affected by the X-Rays, yet they do not possess those properties that have built up the reputation of the Cramer X-Ray plate among experts, and X-Ray specialists.

632. X-Ray plates should be kept in a lead lined case to protect them from the influence of the rays. Nor should plates

before or after exposure be left for more than a short time in the envelopes, as prolonged contact with the paper will injure or spoil the plate. When placing plates in the envelopes keep well away from the dark room light, and put the film side of the plate towards the face of the black envelope, and insert the black envelope flap end down, with the face of the black envelope towards the face of the yellow envelope. Even when in the double envelopes the plates should not be exposed to the influence of strong daylight, but protected by a paste board box, if they are to be carried out of doors, to avoid danger of fogging. Never take a plate near an X-Ray machine when the tube is turned on or it will fog. It is impossible to give any directions for duration of exposure needed, this depending on whether a coil or a static machine is used, and their size and power, as well as on the kind and quality of tube used. Generally speaking, static machines have been superseded by coils on account of the former's lack of power, they only being suitable for light work like the extremities. Most workers believe that a tube of rather low vacuum and high penetrating power makes better negatives than one of high vacuum and high penetrating power, as the latter penetrates the bones so much that there is not sufficient contrast in the negative. In making X-Ray exposures, err on the side of over, rather than under-exposure, and for development use a strong concentrated developer with a good dose of bromide of potassium, and carry development as far as possible (after-reduction is easy if necessary). Either of the X-Ray developers given among formulæ in this article will give good results, the most desirable negative being one of great intensity in the easily penetrated parts, good detail in the tissues with plenty of contrast between them and the bones.

633. Fix the plates in a fresh acid-fixing and hardening bath, leaving them in this bath long enough to harden the film way through.

WARNING :— OPERATORS should not expose their hands or bodies to the influence of the rays for repeated exposures will result in burns which, as far as known, cannot be healed.

"A TOKIO WATERWAY"

STUDY NO. 13, See Page 345 Tokio, Japan — WM. H. PHILLIPS, LIVERPOOL, OHIO

634. CRAMER CONTRAST PLATES.—For copying drawings, engravings, photographs etc., for half-tone plates (Line screen or Process Work).

635. For developing use any of the normal developers, or the Contrast Developer. The two may be mixed in proportions to suit or used in two trays alternately. For producing the greatest contrast, with absolutely clear shadows (black and white), use the developer for line work given among the developers.

636. CRAMER'S TRANSPARENCY PLATES, ON CLEAR OR GROUND GLASS.—Coated with a specially prepared slow emulsion, producing the very finest transparencies or positives on glass. Develop with Transparency developer given among the developers.

637. CRAMER LANTERN SLIDE PLATES.—On first quality, thin crystal glass, producing rich, brilliant slides with absolutely clear glass in the highlights.

638. Lantern Slides can be made from negatives by copying in the camera or by contact. The time of exposure when printing by contact depends on the source of light and the distance of the light from the negative. Under a negative of ordinary intensity at a distance of three feet from the light of an ordinary fish-tail burner, or an incandescent light, a few seconds' exposure will be sufficient. The proper time required can easily be ascertained by a few trials. If the negative is very dense the distance from the light should be shorter, if the negative is thin the distance between the negative and the light should be increased.

639. For developing use Transparency developer, given among the developers.

640. COMPARATIVE SPEED OF CRAMER PLATES.—(Approximately.)—If the Crown requires 1 unit of time, Banner X will require 1¼ units, Blue Label will require 1½ units, Anchor will require 2½ units, Instantaneous Isochromatic will require 1 unit, Medium Isochromatic will require 1⅝ to 2 units, Slow Isochromatic will require 8 to 10 units, Contrast will require 10 to 15 units, Transparency and Lantern Slide 10 to 15 units, Double coats according to brand.

# 1909 SUPPLEMENT.

641. **Panchromatic (Bathed) Plates.**—It has long been known that the introduction of dye stuffs to the sensitive emulsion during the process of manufacture does not give as high a color sensitive effect as may be obtained by bathing the finished plate in a dye bath. The great uncertainty, however, dependent upon this mode of treatment, and the necessary skill and apparatus required for successful results, has precluded its adoption save by isolated individuals. The Cramer Company have recently installed complete apparatus for the production of plates and are supplying plates sensitized for any region of the spectrum.

**Cramer's "Paniso" (Bathed) Plate.**—This plate is sensitive to the entire range of the spectrum from the extreme infra-red to the extreme ultra-violet and *must be* handled and developed in total darkness. That total darkness is a necessity, is simply a tribute to the color sensitiveness of the plate.

The Paniso is primarily suited to the needs of scientific and three-color workers, but they are also particularly well adapted, when used with their proper ray filter, for the commercial photographer, or for anyone who is engaged in the photographing of colored objects.

By their use deep reds and greens which are otherwise either unattainable, or imperfectly rendered, are represented with values absolutely unapproached by any other plate. For landscape photography by advanced workers their use with an **extremely light ray filter** gives **absolutely correct** color values.

As has already been stated, the Cramer Company prepare (on order) plates sensitized for **any** spectral color, but in the use of *all* bathed plates due attention must be paid to the fact that plates so prepared have but limited keeping quality, so should not be stocked in quantities. Such plates are not handled by dealers, but must be ordered direct from the factory.

The introduction of the Paniso among scientists reaped an instantaneous success, for in the hands of Professor Hale of the Carnegie Solar Observatory, were obtained results which shed revolutionary light upon the solar theories.

In the exacting field of photo-micrography, these bathed plates stand for the achievement of the highest possible results. No object is so stained that it cannot be reproduced with full detail.

**Color Screens (or Ray-Filters).**—To appreciate thoroughly the use and value of a ray filter in conjunction with an isochromatic plate it is necessary to give some consideration to the imperfections of the ordinary photographic plate.

All ordinary photographic plates are color blind and therefore represent wrongly the relative brightness of different colors, a dark blue photographing as very light, while a bright yellow is copied as being very dark. Or supposing one is exposing upon a green field in which are clusters of bright yellow flowers, the flowers would be invisible on the finished print (because the plate is not sensitive to yellow), and the whole effect of the scene would be lost.

An isochromatic plate is a photographic plate which has (by changes in manufacture) been made sensitive to the yellow and green. With such a plate a patch of bright yellow is represented as being of about equal brightness with a patch of green or blue, and this is as far as the sensitive plate is capable of.

Now in order to obtain a record of the yellow flowers as being brighter than the green grass, it is necessary to make use of a ray filter which is used in front of or behind the lens, and whose purpose is to dim down or hold back the blue and violet rays to which the plate is too sensitive. When any ray-filter is made use of it slows down the working speed of the plate, because it has filtered out some of the light rays which are falling upon its surface, therefore more time must be given to the exposure.

While any color filter will give effects of a kind, yet for choice results the filter must be adjusted to the plate; it naturally follows that the plate *maker* is in the best position to determine this point. It however, often happens that owing to movement or other causes, it is not possible to give any extended lengthening of the exposure, and retain a sharp picture, and in such cases it is decidedly desirable to sacrifice some of the exactitude of color rendering, and yet obtain superior results. In such cases it would be better to have the view only, say, half corrected, or even less. Again: in the the photographing of a landscape illuminated by the setting sun, it is obviously not necessary to use so deeply colored a ray-filter as at midday, because the view is already colored yellow.

For these reasons the Iso filters are made in three different depths of color requiring respectively double, three times, and five times the exposure necessary for an unscreen plate. They are made of two plates of the very highest grade of optical glass, which have been reground and polished plane, and cemented between them a thin film of dyed gelatine which has been spectrographically adjusted. These filters are made of such exactitude that each or all of the separate shades test precisely identical. They are intended for use behind the lens, fittings being provided with each.

The reason why a ray-filter requires to be adjusted to the plate with which it is intended to be used, is because various plate manufacturers make "iso" or "orthochromatic" plates which are as variously color sensitive as are the number of "brands," consequently the blue and violet require filtering out (or holding back) to a greater or less extent, depending upon the ability of the manufacturer to increase his color sensitiveness in proportion to the action in the blue-violet. The higher the sensitiveness to other colors the quicker the photographic action, and the less dense is the ray-filter.

The Cramer Instantaneous Isochromatic plates have

the highest action in the yellow green of any "iso" or "orthochromatic" plate manufactured; therefore our ray-filters require less time than any other.

While the **Isos** filters are specially adjusted for the Cramer plates, they will perform well with any other "Iso" or "orthochromatic" plate, as they are fitted for work with the highest type of "iso" plate.

**Isos Film Filters.**—For the convenience of those who desire to test for themselves the value of the Isos Ray-filters at a minimum expenditure, we have also made them up in thin gelatine film. This film corresponds to a definite measured amount of dye stuffs dissolved in a definite weighed amount of gelatin, flowed over a definite measured area. These films are guaranteed to be exact spectroscopic duplicates of the permanent cemented filters and are intended for use in front of or behind the diaphragm between the lenses. If an iris diaphragm, simply unscrew the front or back lens and drop in the film (cut to size with a scissors) or if the diaphragms are of the Waterhouse type, then slip it in with the stop. Of course these film-filters are much more easily injured than the permanent glass cemented filters and consequently require to be handled with greater care.

The Isos ray-filters are the most rapid adjusted filters manufactured: the Isos III gives correction which is not obtained by any other filter under **9 times exposure.**

**Isos I** (Light) for objects in motion, studio portrait work, etc., and where but one-half correction is desired. Exposure equals double the time necessary for unscreened plate.

**Isos II** (Medium) for objects and views where more time is allowable, giving about two-thirds full correction. Exposure equals three times.

**Isos III** (Dark) for copying paintings, blue prints, etc., and for use in landscape, portrait and genre photography. Exposure equals five times.

With the Trichromatic plate we do not recommend Isos III for general work: Isos II gives full correction. For the copying of blue prints however, the Trichromatic and Isos III gives positive results.

**Ray-Filters for Photomicroscopists and Commercial Photographers.**—Color screens of this type form a class by themselves. For the commercial photographer who is engaged in the copying of numberless colored articles, furniture, etc., or for the copying of colored labels, writings, and the thousand and one things which go to make up the ordinary line of work, their use is simply invaluable. This class of ray-filters are known as "Contrast Filters" and by their aid the worker can subdue or eccentuate whatsoever color or line he desires. Objects of any color can be represented either with full detail, or full contrast, (either as black or white) according as the filters are used. The Cramer Company stand ready to supply any information on this point which may be required.

*Photomicrographic ray-filters* are a still different type of article, and represent a color screen which can not be made use of as in ordinary photography. They are simply intended for use between the illuminant and the object and for such purpose do not require to be made on optical glass. Their colors are spectroscopically adjusted to the transmission (or absorption) of the stains most commonly in use by micrographic workers. By their use the microscopist is enabled to obtain results in the photography of stained sections, and other preparations which would be impossible except by making use of complicated and expensive spectral light apparatus.

**Monochromatic Color Filters** for the use of spectroscopists, physicists, etc., are also manufactured by the Cramer Company, who have installed a laboratory equipment solely for that purpose, and who are prepared to furnish color filters of any absorption or transmission for any purpose, and upon surfaces of any degree of accuracy required up to a measured error of 1/80,000 of an inch.

**Tri-color Filters.**—There is perhaps no class of color filters in which so great a variance prevails as in filters intended for three-color work. Almost every manufacturer of photographic specialties has at some time or another during the course of his business, produced a set of so-called "adjusted tri-color filters" which, however, are absolutely worthless when it comes to fulfilling theoretical or practical conditions. There are two causes to blame for this condition: First, plate errors, viz., insensitive color regions; and second, imperfect filter absorption, viz., lack of theoretical knowledge. The first of these imperfections has been overcome by the even sensitiveness of the Cramer Paniso plate and the second by placing such work under the direction of an authoritative theoretical and practical worker. The Cramer tri-color filters are not only designed to transmit regions which the concensus of opinion of the world's best worker is however the hues of the three-color printing inks upon which they are coated is tested not only for parallelism, but also for thickness and planeity. This exhaustive testing in the laboratory results in a combination of filters and plate in which the images are of absolutely the same size in all three plates, and the gradation of the copy is faithfully preserved: the optical adjustment of the filter dyes assures clean and correct "cut outs."

The chief source of trouble to the present day American worker is however the hues of the three-color printing inks supplied him by the ink manufacturer which are not nearly correct.

The *G. Cramer Dry Plate Company* have recently established a Research Laboratory for this and kindred work, under the direction of R. James Wallace, formerly Head of the Department of Photophysics of the University of Chicago, and the highest authority in the United States upon all matters connected with the photography of color. This Laboratory is equipped with spectroscopic and general physical apparatus of the most refined, modern type, and its establishment constitutes an innovation in the dry plate

industry of America, which is not even approached by any other manufacturer. Consultation upon all matters connected with the photography of color will receive courteous consideration.

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## PART II.

### SEED PLATES.

*Special notes treating upon the manipulation of the various brands of Seed Plates, compiled especially for this Library by the Seed Dry Plate Company.*

642. Without going into a scientific explanation of the chemical action of the light on the exposed plate, we know that the plate exposed in the camera bears a latent image of various light intensities which must be made visible by development.

643. Intelligent development necessitates a knowledge of the purposes of the various component parts of the developer.

644. *First*, we have the developing agent proper (Pyrogallic Acid, Metol, Hydroquinon, Eikonogen, or other preparations of a similar nature) which, in solution, in a process of oxidization, reduces to a metallic form the silver in the emulsion that has been acted upon by the light. Carbonate of soda or other alkalies increase the affinity of the developing agent for oxygen, and also serve the double purpose of opening the cells of gelatin wherein lie the particles of silver to be acted upon, and this action is slow or rapid in proportion to the amount and quality of the alkali used.

645. The rapid oxidization of the developing agent by the alkali needs a corrective agent which we find in sulphite of soda, which also seeks oxygen, and, used in proper proportion, controls the color of the resulting image.

646. Without the sulphite the negative would be yellow and stained, and as yellow is a non-actinic color, if development were carried to a proper point of density, the highlights would be absolutely incapable of transmitting light, and the resulting print would be chalky white except in the deepest shadows.

647. The action of sulphite of soda is to eliminate this color to a greater or less degree, and the amount used regulates the color, bringing it to the point desired.

648. If too much sulphite be used the resulting negative is blue-gray in color and as this color readily admits the passage of light, the resulting prints are apt to be flat and lacking in brilliancy, unless development is carried to a point of density where many of the higher tones of light run together and are lost. The most desirable color, therefore, in a negative is a warm black with a slight tinge of yellow through the image, keeping in mind that color is equivalent to density, and carrying development only to the point where the highest lights are sufficiently transparent to print detail.

649. This character of negative prints quickly, and if proper balance has been observed in lighting, it will be found the most satisfactory quality for printing in any medium. With a proper understanding of the purposes of the chemicals going to make up the developer it is easy to understand the necessity of maintaining a harmony of arrangement of the component parts, and to adapt them to the conditions under which one is working.

650. It is important in this connection to insure a uniformity of harmony by the use of pure chemicals.

651. Many impure carbonates of soda contain caustic soda or caustic potash, which are most active alkalis, and being an unknown quantity will produce an alkaline action that one cannot provide for. Impure sulphites too are apt to have an indefinite amount of alkali, causing uncertain and variable action.

652. Seed's sulphite and carbonate of soda obviate these uncertainties, as they are always pure and uniform in quality, and once they have been adjusted to produce the required

quality of negative they can be depended on to give uniform results.

653. As to the various developing agents in use, each has its peculiar merits according to the manufacturers, and all are good, either separately or in the various combinations of Metol-Hydro, Eikonogen-Hydroquinone, Pyro-Metol, etc., as given in the formulæ following.

654. Pyro, however, seems to hold its own with the professional photographer owing to the printing color which it gives and the ease of its manipulation.

655. Temperature in development is an important factor, and one too often neglected.

656. The dark room and solutions should if possible be kept at a temperature of sixty-five to seventy degrees Fahr., and the developer should never be permitted to go above seventy degrees in summer, or below sixty-five degrees in winter.

657. Too cold developer in winter produces thin negatives with an appearance of being under-exposed and this effect is also due frequently to plates being kept in a very cold room where they become chilled.

658. Too warm developer, particularly in summer, produces a heavy, flat quality in negatives, lacking in gradation and atmosphere, due to a swelling of the minute cells of gelatine and running together of the deposit of silver. Every dark room should be provided with a thermometer, and solutions tested before developing.

659. A pan of ice water in summer or a pan of warm water in winter in which to set the developing tray temporarily, will be found useful in maintaining a uniform temperature during development.

660. Tank development has its advantages in this regard as the developer being in a compact body, with such a small surface exposed to the air, does not change so rapidly in temperature. Any of the following formulæ can be adapted to tank development by the addition of more water to slow the action and a corresponding increase of sulphite of soda to correct the additional color that comes from prolonged development.

661. Certain control is possible in development, particularly if the exposure is known to be over or under the normal, before development begins.

662. The addition of a few drops of ten per cent. solution of bromide of potassium to the developer and a decrease of the alkali will correct to a great degree an exposure that is very much above the normal. If, however, development has begun before it is discovered that the plate is over-exposed, the developer should be washed out of the emulsion, and the plate immersed in old developer containing bromide. If this does not bring proper balance of highlights and shadows, development should be carried beyond the normal point and the plate reduced with red prussiate of potash (ferricyanide of potash).

663. In known under-exposures of portrait, or pictures made in a low key of light, add two or three times the normal amount of water (warm if in winter) and a slight increase of alkali, and develop till the detail is well out in the shadows; then complete development in normal solution.

664. If a plate shows under-exposure after development begins, take it from the developer and without rinsing it lay it in a tray of water, repeating the process until the detail is well out, and then proceed in normal solution to the required density.

The foregoing applies to indoor exposures.

665. Paradoxical as it may seem, we would recommend opposite treatment for instantaneous outdoor exposures. When this character of exposure is under-timed use less than the normal amount of water and a material increase in the alkali.

666. The point of complete development is often a matter of uncertainty with photographers, largely because of the lack of attention to the temperature of solutions, as negatives will appear to reduce very much in the fixing if developed in cold developers, or the reverse if developed in warm solutions.

667. Another cause of uncertainty in this regard is working in too weak a developing light.

668. The dark room light should be of good volume so development can be judged up to the last stage.

669. There is no light absolutely safe, but a combination of ruby glass and transparent post-office paper will be safe in which to examine plates after development has begun, and should be sufficient volume to enable one to read a newspaper at a distance of two feet from the light.

670. If the quality of the light is correct the quantity need cause no alarm. With this kind of developing light, and provided temperatures are approximately correct, it becomes only a matter of experience to be able to judge the density of negatives during development.

671. Complete development of the negative is reached when all the various light intensities of your subject are recorded in their relative values, and the highlights have reached the limit of density through which you can print detail without obscuring the shadows.

672. There is no rule that can be laid down for determining when this point is reached. Practice, only, will educate the eye to correct judgment of complete development.

673. To our amateur friends whose subjects and exposures vary greatly, we offer the factorial system of development by Mr. Alfred Watkins. The theory of the system is that no matter what the exposure, development proceeds at a regular rate. The time of appearance of the first highlights of the image is a definite fraction of the time in which development is completed.

674. EXAMPLE.— Highlights appeared in 24 seconds and the plate was taken out 240 seconds after the developer was poured on. The print from this negative showed proper contrast.

240 seconds total development.
24 seconds highlight appeared.
10 factor for developer.

For future development with a watch or metronome, note the number of seconds elapsed between the pouring on of the developer and the appearing of the first highlight.

675. EXAMPLE.— Highlights, 35 seconds; time, 10-350 seconds. Cover tray to protect from the developing light and

continue rocking. Three hundred and fifty seconds after the start take the plate from the developer, rinse and fix.

Different developers have different factors. We suggest the following factors for use with our own developing formula :

| | |
|---|---|
| Pyro | 12 |
| Metol-Hydro | 15 |
| Eiko-Hydro | 12 |
| Hydroquinone | 4 |

676. To use this system successfully, always use a normal developer.

For stronger negatives than the normal factor gives, use a higher factor. For weaker negatives use a lower factor. If the lighting is too uniform, flat prints will result and longer development will not improve the contrasts.

677. Temperature of the developer is an important condition in using the factor system. It should be kept uniform during development. Seventy degrees is normal for a developer. Cold developer works too slow and warm developer too fast. With a temperature of about eighty degrees there is danger of frilling.

678. **Developers For Use With Seeds Plates.**

PYRO.

| BY WEIGHT. | | BY HYDROMETER TEST. | |
|---|---|---|---|
| *A.* | | *A.* | |
| Pure Water | 16 ounces. | Pure Water | 16 ounces. |
| Pyro | 1 ounce. | Pyro | 1 ounce. |
| Oxalic Acid | 10 grains. | Oxalic Acid | 10 grains. |
| *B.* | | *B.* | |
| Pure Water | 16 ounces. | Seeds Sulphite Soda Solution Test 60. | |
| Seeds Sulphite of Soda | 2 ounces. | | |
| *C.* | | *C.* | |
| Pure Water | 16 ounces. | Seeds Carbonate Soda Solution Test 50. | |
| Seeds Carbonate of Soda | 2 ounces. | | |
| USE | | USE | |
| *A* | 1 ounce. | *A* | 1 ounce. |
| *B* | 1 ounce. | *B* | 1 ounce. |
| *C* | 1 ounce. | *C* | 1 ounce. |
| Pure Water | 7 ounces. | Pure Water | 7 ounces. |

FACTOR 12.

679. In very cold dark rooms use five ounces of water. In hot weather use ten ounces of water. For double coated plates use eighteen ounces of water.

One-half ounce of *B* will give a warmer tone to the negative. The best printers have a warm brownish black color. If negatives are too yellow or the shadows show the slightest stain, not due to discolored fixing bath, use one and one-half ounce of *B*.

680. Sulphite of soda in solution does not keep well. Solutions over one month old should not be expected to be full strength if not made with pure water, and kept in well stoppered bottles.

681. EIKONOGEN-HYDROQUINONE.

| BY WEIGHT. | BY HYDROMETER TEST. |
|---|---|
| *A.* | *A.* |
| Pure Water..... 48 ounces. | Seeds Sulphite of Soda Solution Test 20 ..... 48 ounces. |
| Seeds Sulphite of Soda 2 ounces. | |
| *Eikonogen .....240 grains. | *Eikonogen .....240 grains. |
| Hydroquinone..... 60 grains. | Hydroquinone..... 60 grains. |
| *B.* | *B.* |
| Pure Water.....16 ounces. | Seeds Carbonate Soda Solution Test 50. |
| Seeds Carbonate of Soda 2 ounces. | |
| USE | USE |
| *A* .....3 ounces. | *A*.....3 ounces. |
| *B* .....1 ounce. | *B*.....1 ounce. |

FACTOR 12.

For double coated plates add four ounces of pure water.

Use more water in hot weather.

*If more concentrated developer is desired in order to secure more contrast, the water in solution *A* may be reduced to 32 ounces. Use boiling water in making up this developer. In cold weather a little glycerine could also be added to prevent precipitation.

682. METOL-HYDROQUINONE.

| BY WEIGHT. | BY HYDROMETER TEST. |
|---|---|
| *A.* | *A.* |
| Pure Water..... 64 ounces. | Pure Water..... 48 ounces. |
| *Metol.....120 grains. | *Metol.....120 grains. |
| Hydroquinone.....120 grains. | Hydroquinone.....120 grains. |
| Seeds Sulphite of Soda 2 ounces. | Seeds Sulphite Test 60 16 ounces. |
| *B.* | *B.* |
| Pure Water.....16 ounces. | Seeds Carbonate Soda Solution Test 50. |
| Seeds Carbonate of Soda 2 ounces. | |
| USE | USE |
| *A*.....4 ounces. | *A*.....4 ounces. |
| *B*.....1 ounce. | *B*.....1 ounce. |
| Pure Water.....4 ounces. | Pure Water.....4 ounces. |

FACTOR 15.

*Dissolve in the order given. Metol should always be dissolved in water before the sulphite is added, or before it is mixed with sulphite solution, otherwise it may precipitate. If crystal sodas are used add 15 grains of bromide of potassium to 16 ounces of *B* solution.

683. ORTOL.

| *A.* | *B.* |
|---|---|
| Pure Water..... 24 oz. | Pure Water.....24 ounces. |
| Potass'm Meta bi-Sulphite. 90 gr. | Seeds Sulphite..... 1 ounce. |
| Ortol.....180 gr. | Seeds Carbonate..... 1 ounce. |

Use equal parts of *A* and *B*.

FACTOR 11.

684. PYRO-METOL.

| BY HYDROMETER. | To Develop Take |
|---|---|
| *A.* | |
| Pyro..... 1 ounce. | |
| Metol..... 60 grains. | |
| Water.....22½ ounces. | Water.....8 to 10 ounces. |
| *B.* | *A*.....1 ounce. |
| Seeds Sulphite—test 60. | *B*.....1 ounce. |
| *C.* | *C*.....1 ounce. |
| Seeds Carbonate Soda—test 50. | |

This developer gives softness and detail.

685. PLAIN FIXING BATH.

| BY WEIGHT. | |
|---|---|
| Pure Water..... 16 ounces. | Hydrometer Test 70. |
| Hypo..... 4 ounces. | |

Do not use a discolored bath. Plates should be left in Fixing Bath at least double the time it takes whiteness to disappear. This bath must be made fresh every day.

686. ACID-FIXING BATH.

| BY WEIGHT. | BY HYDROMETER TEST. |
|---|---|
| *A.* | *A.* |
| Pure Water..... 96 ounces. | Hypo Test 80.....100 ounces. |
| Hypo..... 2 pounds. | Seeds Sulphite Test |
| Seeds C. P. Sulp'te of Soda ..... 2 ounces. | 60..... 16 ounces. |
| *B.* | *B.* |
| Pure Water..... 32 ounces. | Chrome Alum Test 20. 32 ounces. |
| Chrome Alum ..... 2 ounces. | Sulphuric Acid C. P.... 2 drams. |
| Sulphuric Acid C. P... ¼ ounce. | |

687. See that chemicals are entirely dissolved, then pour *B* into *A* slowly while stirring *A* rapidly. This bath remains clear and fixes clean after long continued use, but should be replaced as soon as it becomes exhausted. Never attempt to restore a spent bath by adding more hypo. Plates should be left in bath at least double the time it takes whiteness to disappear.

688. If negatives remain twenty to thirty minutes in this bath, the film will become much hardened. This is a great advantage in summer when washing often softens the film. In hot weather fresh fixing baths should be made up more frequently. By fixing longer, less washing will suffice; fifteen minutes in running water is enough if plates have been thirty minutes in a fresh, quick working fixing bath.

689. WEIGHTS.

The ounce avoirdupois (437½ grains) is the one used.

The quantities given in formulæ are mostly divisible by

four, if smaller quantities of developer are desired. The following approximate metric equivalents may be used:

| | |
|---|---|
| 16 ounces (fluid) | 500 cc. |
| 1 ounce (weight) | 30 grams |
| 60 grains | 4 grams |

## PLATES FOR PORTRAITURE AND GENERAL WORK.

### Gilt Edge 27.

690. This is the fastest plate we make. It is especially suited for all extremely short exposures and flash-light work. Speed is a great help in winter, for then the light almost always seems stronger than it really is, and under-exposures are frequent. On such days when the light is changeable and uncertain, Gilt Edge plates make the most of short exposure and their unusual latitude saves many plates, even when there is large error on the side of over-timing. Owing to their extreme rapidity in portrait work the lighting of the subject should show more snap and roundness than when a slower plate is used. Quality has not been sacrificed to speed in our twenty-seven. It has the fine grain and characteristic Seeds gradation, which means pictures with harmonious contrasts, softness and depth.

### 26x.

691. Our 26x is the most extensively used plate we make. For general portrait work it cannot be surpassed. It gives roundness in gradation from the highest lights to the deepest shadows. There is brilliancy, harmony, and detail through the whole picture. Light the subject as you would have your picture. Only extremes, *i. e.*, light so strong and concentrated as to show unusual harshness, or so broad and so much diffused as to give no point to highlight or shadow, need be avoided. The plate will give you what you see under most adverse circumstances. The 26x plate has a wider latitude than any other portrait plate in the world. It requires one-fourth more exposure than the Gilt Edge 27.

692. **Seeds Tropical Plates.**—The Seeds Tropical is a new plate made for use in hot climates, which will be heartily welcomed wherever heat and humidity make the working of the ordinary plate a difficult matter.

The Seeds Tropical Plate is similar in speed, latitude and gradation to the Seeds 26X, but will not frill, even though the temperature of the developer be as high as ninety degrees Fahr. The proper temperature for working this plate is in fact from seventy degrees to ninety degrees without danger of frilling, and thus gives the benefit of the "Seeds quality" to those who, on account of climate or on account of difficulty in obtaining ice, are not able to properly control the temperature of their solutions.

Use our regular pyro formula for developing.

NOTE.—Developer made up according to the regular formula is intended for use at a temperature of about seventy degrees. If development is carried on at eighty-five degrees or ninety degrees the developer must be diluted one-half by adding water, using fourteen ounces instead of seven ounces.

## DOUBLE COATED PLATES FOR THE PREVENTION OF HALATION IN CASES WHERE CONTRASTS OF LIGHT AND SHADE ARE NECESSARILY VIOLENT.

693. **Non-Halation Plate.**—In photographing interiors the strongest highlights, such as the windows and other out-of-door openings, are almost always very dense and blurred at the edges. This is due to halation or reflection from the inner surface of the glass. Our Non-halation plate is double coated, under coat a 23, the surface a 26x. Consequently, though it has the speed of a 26x, the blur of halation is lost in the brilliant 23 emulsion next to the glass surface. This means that in poorly lighted interiors an exposure sufficient to get detail in the shadows will not endanger the highlights. Snappy detail in the highlights under most trying conditions is the

characteristic performance of this plate. It is especially serviceable in photographing machinery where bright parts and troublesome reflections are unavoidable. We most strongly recommend it for all landscapes, seascapes, white draperies, wedding gowns and other subjects where it is necessary to bring wide contrasts of light and shade into harmony. We also offer it to the amateur as a most economical plate for general use, on account of its remarkable latitude.

694. The normal developer used with ordinary plates should be diluted with an equal volume of water. This allows the developer to penetrate to the lower film before development has made much progress in the upper film. Both films should develop simultaneously. Development in the diluted developer will be much slower, but the results will show.

695. Since the Non-halation is double coated it is almost impossible to judge its density by the developing light as in ordinary practice. It is therefore conservient to determine the completion of the development by using the factor system. Development with pyro (diluted), will be completed in about fourteen times the time in which the highlight appears. The speed of the Non-halation plate may be reckoned the same as the 26x. It should be noted, however, that only in very full timing can the whole advantage of the great latitude and wonderful gradation of this plate be brought out.

696. **Orthochromatic Plates.**— One of the signs of the times is the increasing demand for orthochromatic plates in all classes of work. These are undoubtedly the plates of the future. They will do all that an ordinary plate of the same general character will do, and in many cases much more. Therefore we have been ever ready to meet the demand of the trade for orthochromatic plates of special character for special work. For general all-around work, where the highest color sensitiveness is demanded, the Ortho and the Non-halation Ortho; for commercial work and the reproduction of furniture samples, where increased contrasts are demanded, the C Ortho. With a little care in handling, any of our orthochromatic plates may be developed without trace of fog in a ruby light safe for ordinary plates.

697. **Ortho.**—It is well known that yellow and green values are the life of the picture in many a landscape. In ordinary photographs these bright patches of color are shown as black or very dark. About 90 per cent. of landscape photographs neither give all that the eye sees, nor show the proper relation in what they do give. For instance, it will be found quite impossible to secure with one exposure on an ordinary plate, printable detail in a foreground of green foliage as well as in the light clouds on the horizon. When the Ortho plate is used this is easily obtained. It is impossible on an ordinary plate to get values in autumn scenery. The brilliant coloring of the foliage is much more dull, black and lifeless than it should be. With an Ortho plate the picture tones up wonderfully.

698. The improvement made by the use of an orthochromatic plate will be noticeable. But with a filter difficult problems become easy, and true and exact rendition of color value is obtained. For this purpose we make two filters, a light one for general landscape work and a deep one for work where more exact rendition is necessary as in the reproduction of paintings. These filters are specially adjusted for use with our Ortho and Non-halation Ortho plates and should not be used with any other plates.

699. We strongly commend our Ortho plate to microscopic workers. Because of its high sensitiveness to yellow light the exposure, in cases where the subjects are in yellow stain, will be very much reduced. Subjects in blue stains cannot be photographed successfully on an ordinary plate, but with an Ortho this is possible. A light yellow screen will be useful in obstinate cases.

700. For general all-around work, as well as work in which the highest color sensitiveness is demanded, the Ortho is supreme among single coated plates. It has a most pleasing gradation, vigor, roundness, and fullness, without that harshness which so often characterizes a plate of great color sensitiveness, and which tends to the production of pictures in which chalk and soot effects prevail. Speed is the same as our 26x.

701. **Non-Halation Ortho.**—Many advanced workers use but one kind of plate for all their work. There is much to be said for this system. It is a very rational way of working. To these we especially commend the Non-halation Ortho plate, for it has all the qualities of our regular Non-halation, and all the color sensitiveness of our Ortho. The speed is the same as our 26x, and the latitude the same as the regular Non-halation. It is unquestionably the best plate made in adaptability to every special need in difficult or varied work.

## PLATES FOR SPECIAL, COMMERCIAL AND PROCESS WORK.

702. **Commercial Ortho.**—There has been an increased demand from commercial workers for a plate suitable for reproduction of the grain of wood in mahogany furniture, dark oak, and bird's eye maple. Much practical experience led to the production of this emulsion. The plate has wonderful latitude and a lack of intensity in the middle tones which is so necessary in this class of work. It is so highly orthochromatic as to render all the detail in yellow objects with very short exposure. Its keeping quality is most excellent. This is of the utmost importance in work where quantities of plates must be kept for some time and where increased contrast between the highlights and middle tones is necessary to good results. It has great latitude, works with vigor and is unusually brilliant. Speed same as 26x.

703. **23 Plate.**—This is a slow plate and especially suited for commercial and landscape work. It works with more contrast than the 26x and requires about double the time.

704. **Process Plate.**—This is an emulsion of strong contrasts, especially suitable for giving black and white effects, for copying drawings, manuscripts, plans and printed matter. It requires six times longer exposure than the 26x.

705. **Lantern Slide Plates.**—Our Regular Brand is made with the most perfect glass obtainable. It produces a rich black tone, very bright and crisp. It requires 5 to 6 seconds' exposure at 2 feet from a 16 c. p. lamp. Full directions for development in each box.

706. We recently added another slide plate which we have named the "Red Label" brand. It gives warm black or brown tones by a change in the developer, producing brilliant slides with beautiful detail. We offer this brand at a lower price than our regular plate and we predict that the quality and price will soon make it the most popular slide plate on the market. Full directions for exposure and development follow.

## 707. Developers for Lantern Slides, Transparency and Process Plates.

BLACK AND BROWN TONES.—DEVELOPER FOR BLACK TONES.

| No. I. | | No. II. | |
|---|---|---|---|
| Pure Water | 24 ounces. | Pure Water | 16 ounces. |
| Seeds Sulphite Soda. | 3 ounces. | Potass. Carbonate | 2 ounces. |
| Hydroquinone | 150 grains. | Bromide Potass | 15 grains. |

TO DEVELOP.

Take of No. I.—3 ounces; No. II.—2 ounces.

DEVELOPER FOR WARM TONES.

| No. I. | | No. II. | |
|---|---|---|---|
| Pure Water | 16 ounces. | Pure Water | 16 ounces. |
| Hydroquinone | 50 grains. | Potass. Carbonate | 480 grains. |
| Seeds Sulphite Soda | 50 grains. | | |
| Bromide Potass | 24 grains. | | |
| Citric Acid | 6 grains. | | |

TO DEVELOP.

Take equal parts.

For still warmer tones the amount of sulphite may be reduced.

To make a lantern slide by contact, put the negative face up into an ordinary printing frame and place the lantern slide plate face down upon it, just as with printing on paper.

708. *Exposure:* As a guide we give the following example (taking a medium dense negative), if a 16 c. p. electric

OCEAN WAVES

light is used the exposure should be about two seconds for black tone slides and three seconds for warm tones at a distance of three feet from the light.

709. It should be borne in mind that the results depend much upon the correctness of exposure, hence judgment and practice are necessary with the varying characters of negatives. If there is a doubt in the mind as to the time of exposure required for a certain negative, we would suggest that the aim be for under-exposure rather than over, for a slightly under-exposed lantern slide is always more satisfactory than an over-timed one, because of the indistinctness of the picture when thrown on the canvas.

710. *To Develop:* Temperature of developer should be between 70 and 75 Fahr., and if exposure and temperature of developer are correct the time of development will be about three minutes for either black or warm tones. To proceed, lay the plate face up in a suitable tray and flow the developer over it, allowing the developer to act until sufficient density in the shadows is obtained, then wash well and immerse in the fixing bath.

711. FIXING BATH.

| *A.* | | *B.* | |
|---|---|---|---|
| Water | 64 ounces. | Water | 16 ounces. |
| Hypo | 1 pound. | Chrome Alum | 1½ ounce. |
| Sulph. Soda | 2 ounces. | Sulphuric Acid (conc.) | 1 dram. |

While stirring *A* vigorously, pour in *B* very slowly. This bath will keep, but should be filtered occasionally. The chrome alum bath recommended for our regular plates can be used, also fresh plain bath, hypo 4 ounces, water 16 ounces.

712. Leave plate in bath a few minutes after all white has disappeared from back. Wash well and then wipe surface gently with a wad of wet absorbent cotten. Rinse and set to dry in a ventilated place free from dust. Do not change position of plates while drying as it will show a difference in intensity with different conditions of air.

713. **Orthochromatic Plates and Light Filters.**— When, a few years ago, Orthochromatic plates made their in-

itial appearance before the photographic public, the venture was looked upon by the average amateur merely as a somewhat interesting experiment. The importance of the discovery which rendered such a product possible was not realized and although conceded to be of much interest, yet it did not seem to materially concern their work. The professional photographer simply ignored them.

714. The Orthochromatic plate, however, has steadily gained in favor and the many "conventions" and "salons" which have been organized in later years have greatly served to demonstrate the advantages to be gained from their use, until, at the present time, there is no plate maker of note throughout Europe or America who does not supply such an article in one or more "brands."

715. The principles of orthochromatism are now (thanks to the many writers on that subject) fairly well understood among photographers, but to the ever increasing army of new workers a brief explanation is essential to intelligent use, while even to those who are further advanced, a concise account may not be out of place.

716. *Briefly:* "White" light, so called, is a complex mixture of seven different colors which are respectively red, orange, yellow, green, blue, indigo, and violet, and these colors arranged in the above order constitute the "visible spectrum" (or image) of that light when it is observed through a glass prism. Besides this there is another region known as the ultra-violet, which is totally invisible to the human eye, but to which the photographic plate is very sensitive — whether it be "ordinary" or "orthochromatic."

717. All objects in Nature appear colored because they reflect more of some one color than another — those colors which they reflect less being absorbed by the object itself.

718. The ordinary photographic plate is not sensitive to all of those colors, but only to a very limited number — in fact only three — the blue, indigo, and violet; and also to the ultra-violet. The result is, that the red, orange, yellow or green have no action on the plate at all, and hence are represented as black. The print then is altogether untrue to the

original in all save shape — a dark violet object for example, being represented as a bright white; while, on the contrary, the brightest of all colors — yellow — will be black.

719. The Orthochromatic plate is the result of the addition of certain dye stuffs into the sensitive coating, which makes the plate capable of being impressed by other colors, viz., the yellow and green.

720. Although the plate is now sensitive to yellow and green, yet it is still much more sensitive to blue, violet, and the invisible ultra-violet, and, to render the colors of Nature in anything like their relative brightness to one another, it is necessary to tone down those colors which act too strongly, so that the others may have a chance to impress themselves with sufficient strength. This is accomplished by the employment of a colored screen, or more properly speaking — a light-filter.

721. The first object of such a filter is to cut off entirely the invisible ultra-violet, so that it may no longer impress itself. Next, it must absorb a definitely measured amount of blue, indigo and violet lights, so that they do not act any more strongly than is necessary to show objects so colored in their proper brightness. If the filter should tone down these hues too much, then the result would be just as far wrong the one way as it was the other It is therefore obvious that a filter adjusted to one make of orthochromatic plate, will not give equally good results with some other.

722. The Seeds "Chromatic Curve" filter is adjusted by careful spectroscopic and other measurements, so that it conforms exactly to the needs of the Seeds "ortho" plate, the combination giving results which reproduce with the utmost fidelity the varying luminosities of the object photographed.

723. The Seeds "Compensator" filter is very much lighter in color, and — as its name implies, is for use in compensating the errors of the plate — its duty is to absorb entirely and completely the invisible ultra-violet, and slightly subdue the visible violet. (This filter does not possess the measured adjustment of the "Chromatic Curve.")

724. These filters are arranged for the utmost convenience in every day use, being manufactured of optical plane glass, held in a handsome metal cell with adjustable clasps to fit slightly varying sizes of lenses.

725. In use, the filter is simply slipped on the front of the lens hood, and focusing proceeded with as usual.

726. **The Panchromatic Plate.**— Orthochromatic photography is the means by which we obtain, with the aid of properly prepared plates, the light intensity values of objects not obtained by the use of the ordinary dry plate, commonly used in photographic work.

727. Orthochromatic, from the Greek words, Orthos = correct, and Chroma = color.

728. The Panchromatic plate, a late addition to the utilities in the field of orthochromatic photography, is so prepared that it is sensitive, in almost a like degree, to all colors under certain condition, i. e., in combination with various color screens.

729. One must not, however, form the impression that color contrasts can be rendered, but it makes possible the recording in monochrome, contrasts of light and shade in proportionate intensities as seen by the naked eye. This in turn requires that we determine the predominating color, and select the screen that will give to that particular color and minor surrounding colors, the best value as to their light and shade.

730. The extreme sensitiveness of this plate to the various colors make it valuable in connection with the Three-color Process which, as is well known, requires that three separate negatives be made, termed the Red, Blue and Yellow plates, necessitating the use of three separate color screens, green, red, and violet.

731. DEVELOPMENT.— Due to its sensitiveness, the Panchromatic plate should be developed in total darkness for from five to six minutes (according to the density required in the negative).

732. FORMULA.

*By Weight.*

| | | |
|---|---|---|
| *A.*— | Pure Water | 16 ounces |
| | Pyrogallic Acid | 1 ounce |
| | Oxalic Acid | 10 grains |
| *B.*— | Pure Water | 16 ounces |
| | Sulphite of Soda | 2 ounces |
| *C.*— | Pure Water | 16 ounces |
| | Carbonate of Soda | 2 ounces |

Use *A* 1 ounce; *B* 1 ounce; *C* 1 ounce; Pure Water, 7 ounces.

*By Hydrometer Test.*

| | | |
|---|---|---|
| *A.*— | Pure Water | 16 ounces |
| | Pyrogallic Acid | 1 ounce |
| | Oxalic Acid | 10 grains |

*B.*—Sulphite of Soda, Solution Test sixty degrees.

*C.*—Carbonate of Soda, Solution Test fifty degrees.

Use *A* 1 ounce; *B* 1 ounce; *C* 1 ounce; Pure Water, 7 ounces.

NOTE.—Extreme softness, or low tone values, may be had by diluting the normal developer and increasing the time of development accordingly.

A fresh fixing solution should be used in order that the plates are free from all stains.

After fixing they may be handled in the usual manner.

## PRACTICAL ADVICE.

733. EXPOSURE.—For most subjects the latitude of a plate will be about two, that is, if one second were correct exposure, two seconds would not be too much for safety. For beginners an open, sunlit landscape is a good subject for the first experience. Try three exposures 1-100, 1-50 and 1-25 of a second. In some cases all three might be good and in others none, but there will be evidence enough to give a line on correct exposure. If the shutter has but one speed, or is not reliable, the same experiment may be tried by starting at a full open lens and reducing the stop one size each time.

734. The light varies in intensity from hour to hour during the day and from month to month during the year. In win-

ter exposures at noon should be from two to four times longer than at noon in June.

735. Exposures near sunset should be five to ten times longer than at noon. On hazy days when sun casts weak shadows, expose twice as long as on bright days, when the sun casts deep black shadow.

736. On very dull days when the sun casts no perceptible shadows expose four times as long as for bright days. Even at best the picture will be flat, but if under-exposed it will also be weak and thin. If a landscape has dense foliage in the foreground double the exposure.

737. Sea and snow require but one-half to one-fourth landscape time.

738. DEVELOPING LIGHT.—Ruby glass is the best medium to use in the construction of a light. Some ruby glasses pass light which will fog a plate in short order, but a large percentage of them are safe for all practical purposes. The principal object is to see what is doing. There is least strain to the eyes when the light which illuminates the work is moderately strong but not harsh. A little diffusion through several sheets of yellow tissue paper will secure this quality. It will be found that no light in which the shape of the illuminant (gas flame, or candle, or incandescent filament) can be distinguished, is a safe or pleasant one to use.

739. There is hardly any light which is safe and at the same time strong enough to be useful. The proper way is to get a diffused red light which is comfortable and then make a practical test to see how soon a plate exposed to it fogs.

740. Put a plate in the plate holder in perfect darkness; then place the holder where you generally develop, draw the slide half across the plate and expose to the developing light as long as it generally takes to develop a negative. Then develop the plate in perfect darkness the usual time, wash and fix. If any difference is then found between the exposed and unexposed parts of the plate, it is proof that the light is not safe for very sensitive plates.

741. It should be pointed out that Orthochromatic plates are very much more sensitive to the developing light than reg-

ular plates and therefore require some special care in handling, though they do not necessarily require a special light for their development. The ordinary light will be quite satisfactory unless the development of the fastest ordinary plates by it is risky. After the developer has been poured on, Orthochromatic plates are not a great deal more sensitive to red light than ordinary plates. The greatest care should be in handling before development. Keep as far away from the light as possible until the plate is covered with developer.

742. Drying Negatives.—The warmer the air in which negatives are dried, the more intense they become. Negatives should be dried in a current of air. If more than two hours are consumed in drying, trouble may result, even if the temperature be moderate. Never move negatives from one place to another during drying, or marks will result.

743. Flat Negatives.— When the negatives are thin and weak and density cannot be gained in prolonged development, under-exposure is the cause.

744. When there is good printing detail in the shadows, but the highlights lack point and snap, too flat lighting is the cause. Use rounder contrasts so as to give the highlights a full exposure. The light which models the subject should be sufficiently concentrated. Do not use too diffused a light on the subject, or relieve the shadows by a side reflector. Use the reflector more from the front, if at all.

745. Under-development causes lack of contrast. Do not be deceived by apparent strength, when developer is of higher temperature than 75 Fahr.

746. Frilling and Softening of the Film.—Keep developer under 75 Fahr., and baths and washing water as near that temperature as possible. Any large difference in the temperature of these solutions will cause frilling in any kind of weather. Use ice to keep the developing solution at proper temperature. If ice is not at hand use more water in developer. Use fresh, quick working baths or the acid hardening bath. Fix longer and wash less. Plates should be thoroughly fixed and then washing fifteen minutes in running water will be sufficient

747. Weakness of Image.—Due to under-development, caused by too cold or to weak developer. Developer should be 70 degrees Fahr. in temperature and contain 2½ to 3 grains of pyro to the ounce of developer. After development the developer (pyro) should be clear red and not a dirty brown.

748. Slowness of Development.— Caused by cold or weak developer or under-exposure. Often a smoky lens or dirty skylight causes the under-exposure. It should be pointed out that developers made with Seeds Sodas develop more slowly, but their action is more uniform and the negatives are clearer and brighter.

749. Too Much Contrast is generally caused by harsh, unnatural lighting of the subject. If the plate is under-exposed, too much contrast frequently results from carrying on the highlights to too great density in hope of bringing out more detail in the shadows. The best results in under-exposure are obtained by stopping development before the highlights come to the limits of printing density.

750. Fog.— Fogged negatives are frequently caused by an unsuitable developing light. Prolonged or forced development, allowed in hopes of getting more density than the exposure and lighting should give, veils the shadows. Too much alkali or too warm developer also cause fog. Use normal developer at a temperature of 70 degrees Fahr. Leaky cameras or plate holders cause foggy or light struck negatives. The little shutter in the plate holder may not close after the slide is drawn. Avoid the possibilities of these troubles by making a habit of covering the camera and plate holder with the dark focusing cloth during drawing of slide and exposure of plate.

751. Our Demonstrators frequently find that light enters the camera where the bellows are attached to the back part of the camera, between the back board and carriage for holder and between holder and carriage. This defect has so often been found to be the cause of flat, weak, foggy negatives, that we give the following directions to discover it. Take the camera out into strong light, take out lens and facing the light place head in camera until the forehead touches the back of the plate

holder. Remain in this position until the eyes become accustomed to the absence of light, for until then the leak would not probably be seen.

752. Fog is also caused by dust or a hazy atmospheric deposit on the lens which carries a diffused light into the camera, distributing it over the plate. Keep lenses clean.

753. To Clean a Lens.—First spread upon a table a clean sheet of paper; take your lens carefully apart; now dust with camel's-hair brush each lens on both sides; then take a clean graduate, pour in two ounces of distilled water, one ounce of alcohol and three drops of nitric acid (C. P.), mix well, and with a tuft of filtering cotton dipped in this solution, rub the lens on both sides; polish with a clean chamois which is kept for this purpose only, which, when not in use, put away in a clean paper bag. After the lenses are all polished, before putting together, wipe out carefully the brass tube; then dust each lens with a camel's-hair brush (never blow on them) and put together. A lens cleaned in this way will keep clean much longer than it would if simply wiped with a chamois.

754. Spots.—Numerous round and very small transparent spots are generally due to rinsing the plate before developing. Carefully avoid this with our plates.

755. Large round spots, but less numerous, are caused by bubbles in the developer, often due to water containing vegetable matter. Melted ice, distilled or well water should be used if possible. Angular spots are due to dust on the plate at the time of exposure. Plates should be dusted with a camel's hair brush before development and the plate holder and camera kept scrupulously clean. The dusting may electrify the plate if done too vigorously.

756. Triangular Transparent Spots are caused by using a developer on which a scum has formed. It should not be used without filtering. The scum forms rapidly if the room is warm and the water used contains organic matter.

757. Opaque Spots and Lines are caused by allowing pyro, hypo or sal soda to get on the dusting brush. The dark room should be kept absolutely clean, any spilled hypo or other

solutions should be wiped up immediately, for after drying the dust of chemicals will float about in the air and cause endless trouble.

758. Small Opaque Spots may also be due to the presence of iron in the water. To avoid same a canton flannel bag should be so tied over the faucet that the water filters through it. The spots may be removed by diluted sulphuric or muriatic acid.

759. Blurred Opaque Finger Marks or Spots are caused by placing plates face to back after exposure. Plates left in such contact any length of time will transfer any markings from the back of one plate to the sensitive surface of another. Always put plates away face to face after exposure.

760. Granularity of Negative.— This is usually a warm weather trouble. The developer should not be too strong in alkalinity or too warm. Fix well in a strong, fresh, acid alum bath. Dry in a current of air.

761. The Making up of Developer Solutions.— If distilled water only were used in making solutions of developer, half the troubles of development would be avoided. If river water is taken, it should be boiled, cooled and filtered before mixing, as it generally contains much vegetable and other organic matter. Well water that is free from iron and sulphur, and not too alkaline, may be used without boiling. Melted ice is good, but should be filtered.

762. The Developer should be made up with reliable chemicals to an established formula strictly according to instructions. When a convenient way of making up the solution has been fixed upon, those particular weights and measures should be used thereafter. This procedure should be so much a habit, and the confidence in the materials used (this includes the water) should be so based upon past experience or the guarantee of reliable people, that the developer should be the last place to look for trouble. A great many troubles laid at the door of the developer, are the result of mistakes in exposure and lighting. The worker should be sure that his lighting ought to give him the desired contrasts and that his exposures are sufficient and not too great, before blaming the developer.

## PART III.

### HAMMER PLATES.

*Special notes treating upon the manipulation of the various brands of Hammer plates, compiled especially for this Library by the Hammer Dry Plate Company.*

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(For the best results we recommend Hammer formulæ for Hammer plates.)

763. For professional work we think pyro and soda produces negatives that have the best printing quality (others may think differently; everyone is entitled to his own opinion).

764. But never condemn nor criticise the chemical effect of a Hammer Plate when it has been developed with some other formula (a formula that has been prepared for some other plate).

765. Any good developer may be used on the Hammer Plate, but if you want to use the developer that is best suited for the Hammer Plate and consequently will produce the best results, use the pyro and soda formula as published herein. Most other developers are stronger than necessary for this plate. The quality is in the Hammer emulsion and does not require any forcing to bring it out. Chemical actions that are forced through hurriedly will result in loss of quality.

766. IMPORTANT CAUTION.—The importance of care in weighing and measuring the several ingredients of a developer cannot be too strongly urged. The quantities and proportions recommended in the several formulæ herewith have been arrived at after most careful study and experiments. Developers cannot be made up successfully by guesswork. If the best results are desired with any given formula, its proportions must be accurately weighed and measured.

### GOOD DEVELOPING FORMULAE FOR HAMMER PLATES.

767. The quantity of sodium sulphite in the developer must be regulated to produce the color desired. It is to the

photographer's advantage, when using pyro developer, to use our formula, as most other formulæ call for more pyro than is necessary for our plates.

PYRO AND SODA (*By Weight*).

No. 1

| English Weights and Measure. | | Metric Weights and Measure. |
|---|---|---|
| 30 ounces Pure water | or | 900 c.c. |
| 5 ounces Sodium Sulphite (crystals) | or | 150 grammes |
| 2½ ounces Sodium Carbonate (crystals) | or | 75 grammes |

No. 2

| | | |
|---|---|---|
| 24 ounces Pure water | or | 720 c.c. |
| 15 grains Oxalic Acid (dissolved) | or | 1 gramme |
| And then add — | | |
| 1 ounce Pyrogallic Acid | or | 30 grammes |

To develop, take :—

| | | |
|---|---|---|
| 1 ounce of Solution No. 1 | or | 30 c.c. |
| ½ ounce of Solution No. 2 | or | 15 c.c. |
| 6 to 8 ounces Pure water | or | 180 to 240 c.c. |

More water may be used in warm weather, and less water in cool weather.

768. PYRO DEVELOPER WITH CARBONATE OF POTASH.

No. 1

| English Weights and Measure. | | Metric Weights and Measure. |
|---|---|---|
| 32 ounces Pure water | or | 960 c. c. |
| 8 ounces Sodium Sulphite (crystals) | or | 240 grammes |
| 1 ounce Carbonate of Potash (dry) | or | 30 grammes |

No. 2

| | | |
|---|---|---|
| 24 ounces Pure water | or | 720 c.c. |
| 15 grains Oxalic Acid (dissolved first) | or | 1 gramme |
| 1 ounce Pyrogallic Acid | or | 30 grammes |

To develop, take : —

| | | |
|---|---|---|
| 1 ounce of Solution No. 1 | or | 30 c.c. |
| ½ ounce of Solution No. 2 | or | 15 c.c. |
| 6 to 8 ounces of Pure water | or | 180 to 240 c.c. |

When the plate is fully developed and you find the high-lights too thin, use less water in the developer; if too dense, use more water.

769. PYRO AND SODA. (*Three solutions by weight and by hydrometer.*)—This formula is better suited to all localities than is a two-solution developer. Each property of the developer being separate, the user can vary the quantity of either to meet local conditions. The water in some places is alkaline; then less of No. 2 Carbonate of Soda should be used. A few trials will indicate the amount that should be used in order to produce the best results. In cold weather the carbonate of soda can be increased a little. During hot weather it is generally best to use a little less of the No. 2 solution, for if the temperature is very high and too much of this chemical is present, the user will destroy the clearness of his plate. The sulphite being in a separate (No. 1) solution, the user can easily modify results by varying the proportion. The water in some localities does not require as much sulphite as in others. Use just enough of the sulphite solution to give the proper printing color to the negative (just a trace of yellow).

No. 1

| English Weights and Measure. | | Metric Weights and Measure. |
|---|---|---|
| 15 ounces | Pure water ..... | or 450 c. c. |
| 5 ounces | Sulphite of Soda (crystals) | or 150 grammes |

Hydrometer test eighty degrees.

No. 2

| | | |
|---|---|---|
| 15 ounces | Pure water..... | or 450 c. c. |
| 2½ ounces | Carbonate of Soda (crystals) | or 75 grammes |

Hydrometer test forty degrees.

No. 3

| | | |
|---|---|---|
| 24 ounces | Pure water..... | or 720 c. c. |
| 15 grains | Oxalic Acid..... | or 1 gramme. |
| 1 ounce | Pyrogallic Acid.. ..... | or 30 grammes |

TO DEVELOP, TAKE:

½ ounce of each, No. 1, No. 2, No. 3 .....or 15 c. c.
6 to 8 ounces Pure water.....or 180 to 240 c. c.

770. If the subject has strong contrasts of light and shadow, use a little less of No. 3 and a little more water than usual.

771. If the subject is flat and lacking in contrast, increase the amount of No. 3 and use a little less of No. 2; a few drops of bromide solution will be beneficial.

772. Keep developing solutions cool and use more water in hot weather.

773. Do not use a cold developer in cold weather. The water may be decreased when the temperature is low.

774. For Non-Halation (double-coated) Plates, use about one-third more water; the development will be slower, but the results will justify the extra time spent in this way.

775. THE ACID CHROME-ALUM FIXING BATH.—Experience has taught us that negatives obtained with an alkaline developer are best fixed in a fixing bath having an acid reaction. We cannot urge too strongly upon our patrons the use of our acid chrome-alum fixing bath throughout the year; it has the following advantages over the ordinary fixing bath:

No. 1. In use, it remains clear.

No. 2. Negatives fixed in it give a uniformly favorable color for printing, free from spots, streaks and stains.

No. 3. It hardens the film of the negative, producing quicker drying and preventing excessive intensity incident to slow drying in a hot room. This is an advantage not to be overlooked in warm weather.

No. 4. It instantly arrests development.

See formula under title, FIXING, paragraph 802.

776. PYRO AND POTASH. — (*By Hydrometer.*)

NO. 1 SOLUTION.

Sodium Sulphite testing sixty degrees.

NO. 2 SOLUTION.

Potassium Carbonate testing thirty degrees.

No. 3 Solution.

| English Weights and Measure. | | Metric Weights and Measure. |
|---|---|---|
| 16 ounces of Pure water | or | 480 c. c. |
| 15 grains of Oxalic Acid | or | 1 gramme |
| 1 ounce of Pyrogallic Acid | or | 30 grammes |

To Develop, Take:

| | | |
|---|---|---|
| 1 ounce of Solution No. 1 | or | 30 c.c |
| 1 ounce of Solution No. 2 | or | 30 c.c. |
| ½ ounce of Solution No. 3 | or | 15 c.c. |
| 8 ounces of water | or | 240 c.c. |

When solutions are made up by hydrometer, the temperature must be taken into consideration; for if the hydrometer is used to test the same solution at different temperatures, there will be a difference in the reading of the hydrometer scale.

777. A Good Pyro Developer.

No. 1

Sodium Sulphite, hydrometer test sixty degrees.

No. 2

Sodium Carbonate, hydrometer test thirty degrees.

To Make No. 3, Take.

| English Weights and Measure. | | Metric Weights and Measure. |
|---|---|---|
| 12 ounces of No. 1 | or | 360 c.c. |
| And to this add — | | |
| 2 ounces of Sulphurous Acid | or | 60 c.c. |
| Then add — | | |
| 1 ounce Pyrogallic Acid | or | 30 c.c. |
| Lastly add — | | |
| 1 ounce Pure Glycerine | or | 30 c.c. |

To Develop, Take:

| | | |
|---|---|---|
| 2 ounces of Solution No. 1 | or | 60 c.c. |
| 2 ounces of Solution No. 2 | or | 60 c.c |
| 1 ounce of Solution No. 3 | or | 30 c.c. |
| 8 to 12 ounces of Pure water | or | 240 to 360 c.c. |

In warm weather use more water, in cold weather less.

### 778. Pyro-Metol-Tolidol Developer.

("This is a good developer; some think it has no equal."—Eppert.)

No. 1

Sulphite of soda.....testing sixty degrees

No. 2

Is made by mixing together equal quantities of:

Carbonate of Soda .....testing sixty degrees
Carbonate of Potash .....testing sixty degrees

No. 3

| | |
|---|---|
| Water | 11 ounces |
| Pyro | ½ ounce |
| Metol | 120 grains |
| Tolidol | 120 grains |
| Citric Acid | 60 grains |

1 ounce of No. 1 (sulphite testing sixty degrees).

To Develop, Take:

| | |
|---|---|
| Water | 6 to 10 ounces |
| No. 1 | ½ ounce |
| No. 2 | ½ ounce |
| No. 3 | 2 to 4 drams |

During the warm weather leave out the carbonate of soda in No. 2, using the carbonate of potash (testing sixty degrees by hydrometer) alone.

### 779. Metol and Hydroquinone Developer.

No. 1

| English Weights and Measure. | | Metric Weights and Measure. |
|---|---|---|
| 80 ounces of Pure hot water | or | 2400 c.c. |
| 1 ounce of Metol | or | 30 grammes |
| ⅛ ounce of Hydroquinone | or | 4 grammes |
| 6 ounces of Sulphite of Soda (cryst.) | or | 180 grammes |

No. 2

| | | |
|---|---|---|
| 80 ounces of pure water | or | 2400 c.c. |
| 5 ounces of Carbonate of soda (cryst.) | or | 150 grammes |

To Develop, Take:

2 ounces of Pure water .....or 60 c.c.
1 ounce of Solution No. 1 .....or 30 c.c.
1 ounce of Solution No. 2 .....or 30 c.c.

For those who wish to make only a small quantity of developer, the following formula will answer:

No. 1

| English Weights and Measures. | | Metric Weights and Measures. |
|---|---|---|
| 8 ounces of Pure water | or | 240 c.c. |
| 150 grains of Sulphite of soda (cryst.) | or | 10 grammes |
| 60 grains Eikonogen | or | 4 grammes |
| 8 grains Hydroquinone | or | ½ gramme |

No. 2

8 ounces Pure water .....or 240 c.c.
150 grains Carbonate of Potash (dry) or 10 grammes

To Develop, Take:

2 ounces of Solution No. 1.....or 60 c.c.
1 ounce of Solution No. 2.....or 30 c.c.

Can be used repeatedly until exhausted.

780. Eikonogen-Hydroquinone Developer.

As used on *Hammer Plates* by prominent photographers.

No. 1

| English Weights and Measures. | | Metric Weights and Measures. |
|---|---|---|
| 64 ounces of Pure water | or | 1920 c. c. |
| 1 ounce of Eikonogen | or | 30 grammes |
| ⅛ ounce of Hydroquinone | or | 4 grammes |
| 2½ ounces of Sulphite of Soda (cryst.) | or | 75 grammes |

No. 2

64 ounces of Pure water .....or 1920 c. c.
2½ ounces of Carbonate of Potash. (dry) or 75 grammes

To Develop, Take:

2 ounces of Solution No. 1 .....or 60 c. c.
1 ounce of Solution No. 2 .....or 30 c. c.

And old developer (solution previously used) in sufficient quantity to produce best results.

781. PYRO AND METOL DEVELOPER.

No. 1

| English Weights and Measures. | | Metric Weights and Measures. |
|---|---|---|
| 57 ounces of Pure water | or | 1710 c. c. |
| 2½ ounces of Sulphite of soda (cryst.) | or | 75 grammes |
| 1 ounce of Metol | or | 30 grammes |

No. 2

| | | |
|---|---|---|
| 57 ounces of Pure water | or | 1710 c. c. |
| 2½ ounces of Sulphite of Soda (cryst.) | or | 75 grammes |
| ¼ ounce of Pyrogallic Acid | or | 8 grammes |

No. 3

| | | |
|---|---|---|
| 57 ounces of Pure water | or | 1710 c. c. |
| 2½ ounces of Carbonate of Potash | or | 75 grammes |

TO DEVELOP, TAKE:

| | | |
|---|---|---|
| 3 ounces of Pure water | or | 90 c. c. |
| 1 ounce of Solution No. 1 | or | 30 c. c. |
| 1 ounce of Solution No. 2 | or | 30 c. c. |
| 1 ounce of Solution No. 3 | or | 30 c. c. |

This developer may be used repeatedly, by adding a little fresh developer as required.

Keep the used developer in a separate bottle. It combines the desirable qualities of metol and pyro, and gives an ideal negative.

782. ANOTHER PYRO-METOL DEVELOPER.

No. 1

| English Weights and Measures. | | Metric Weights and Measures. |
|---|---|---|
| 27 ounces of water | or | 810 c. c. |
| 1 ounce of Pyro | or | 30 grammes |
| 60 grains of Metol | or | 4 grammes |

No. 2

Carbonate of Soda.....Testing forty degrees.

No. 3

Sulphite of Soda.....Testing seventy to eighty degrees.

For use, take 1 ounce each of No. 1, No. 2 and No. 3, in 8 to 12 ounces of water, or 30 c. c. each of No. 1, No. 2 and No. 3, in 240 to 360 c. c. of water.

## DEVELOPING FORMULAE FOR HAMMER LANTERN PLATES.

783. Pyrocatechin Solution.—A one-solution, quick-acting developer, giving black tones.

| | |
|---|---|
| Boiled or distilled water | 5 ounces |
| Pyrocatechin | 120 grains |
| Bromide of Potash | 8 grains |
| Sulphite of Soda | 1 ounce |
| Caustic soda (in sticks) | 60 grains |

Dissolve each ingredient in the order named.

For Use, Take:

One dram of this stock solution to each ounce of water.

784. Eikonogen-Hydroquinone Developer:—Warmer tones.

No. 1

| | |
|---|---|
| Pure water | 15 ounces |
| Sulphite of Soda | 6 drams |
| Citric Acid | 15 grains |
| Eikonogen | 90 grains |
| Hydroquinone | 45 grains |

No. 2

| | |
|---|---|
| Pure water | 10 ounces |
| Caustic soda (in sticks) | 60 grains |
| Bromide of Potash | 60 grains |

For Use, Take:

| | |
|---|---|
| Solution No. 1 | 2 ounces |
| Solution No. 2 | 1 ounce |

785. The fixing bath must be fresh and clean. Use about six (6) ounces hypo to the pint of water, or use our acid chrome-alum fixing bath.

786. The plate must be thoroughly fixed and thoroughly washed. When the last trace of silver bromide disappears, consider the plate only half fixed.

787. It is advisable (after washing well) to use a clearing solution, even if there is no stain apparent.

788. The plate must be well washed before putting it into the clearing solution.

789. The tone of a lantern slide made on these plates may be decided either by the length of exposure and the development, or by an after-process.

790. The rule of development toning is that prolonged exposure and a heavily restrained developer give warm tones. The restrainer generally used is a ten-per-cent. potassium bromide solution.

791. HYDROQUINONE DEVELOPER.— (*For black tones.*)

| English Weights and Measures. | | Metric Weights and Measures. |
|---|---|---|
| 20 ounces Distilled water | or | 1000 c. c. |
| 60 grains Hydroquinone | or | 7 grammes |
| 2 ounces Sulphite of Soda (cryst.) | or | 100 grammes |
| 6 ounces Carbonate of Soda (cryst.) | or | 300 grammes |
| 40 grains Bromide of Potash | or | 4.6 grammes |

(Use without diluting.)

Dissolve the hydroquinone in the water and add the other chemicals in the order given.

792. If the plate is properly timed, development will be complete in about two minutes. This developer can be used for several plates by adding a little fresh developer to that used after each development.

793. Some lantern slide experts prefer to slightly overdevelop, and then after fixing and washing to reduce the slide to the proper density; this method produces very crisp, clear slides. Those wishing to try this method should use our Howard Farmer reducer. This reduction can be done by daylight. Wash well after reducing and rinse in absolutely clean water before setting up to dry.

794. HAMMER'S DRY POWDER DEVELOPER.— (*For the amateur.*) (Factor 8.) Is compounded with accuracy from the best of chemicals insuring good results to the user.

795. The only caution that is necessary is for the user to be sure that both powders are entirely dissolved; then if the plate has the correct exposure (or near it) a good negative will result.

796 We do not advocate this developer in preference to those that may be prepared from our published formulæ, if good chemicals are used; but for those who do not wish to make up stock solutions, or when going on a trip they wish to carry the developer in a form that shall not cause damage to other goods in case of breakage, this is just the developer that will fill the bill for this purpose, as a trial will convince you. There are none better and we have found none as good (in this class).

797. This developer is enclosed in sealed glass tubes, six tubes in a box. Each tube will make from five to seven ounces of developer. (The more water used the softer the effect.)

798. NEGATIVES.— Negatives suitable for all the different printing processes—carbon, platinum, albumen, collodion, gelatine, etc.,— may be successfully and easily made on the Hammer Plates by a slight modification of the developing solutions.

799. WASHING AFTER DEVELOPMENT.— In all cases it is desirable to wash the plate for at least two minutes before fixing it.

800. FIXING.— The plain fixing bath is a solution of hypo-sulphite of soda, of a strength of about five (5) or six (6) ounces to the pint of water. A fully saturated solution diluted with an equal quantity of water is of about this strength. The plate should be left in the fixing bath for several minutes after it appears to be cleared; as long as it took to fix would not be too much. Neglect of this precaution may lead to the formation of insoluble compounds in the film, which, although not visible at first, may in time result in stains or even total decay of the negative. Commercial hypo-sulphite of soda

usually contains foreign matter, which, if allowed to remain in the solution, will cause spots on the negative. Filter before use. If the regular fixing bath is too strong and not stirred before use, it will at times cause parallel lines on the negatives that were fixed in grooved fixing boxes.

A cool fixing bath can be prepared by dissolving a fresh lot of hypo for each batch of plates. This is of benefit during the hot weather.

801. Acid-Fixing Bath.— Owing to the quality of the water in some localities, some workmen prefer an acid-fixing bath. The following is good and remains clear (mix in order given):

| | |
|---|---|
| Water (about) | 120 ounces |
| Sulphuric Acid | 3 drams |
| Sulphite of Soda | 4 ounces |

When dissolved, add:

| | |
|---|---|
| Hypo-sulphite of soda | 2 pounds |
| Water to make | 160 ounces |

802. Acid Chrome-Alum Fixing Bath.—This kind of a bath has been in use for years and is preferred by many (mix only in the order given):

| | |
|---|---|
| Water (about) | 100 ounces |
| Sulphuric Acid | 3 drams |
| Sulphite of Soda | 4 ounces |

When dissolved, add:

| | |
|---|---|
| Hypo-sulphite of Soda | 2 pounds |

Dissolve, and then add:

Chrome-alum, from 1 to 2 ounces, previously dissolved in 20 ounces of water. Then add water to make 160 ounces.

803. Acid-Fixing Bath. (*For Lantern Slides.*)— An acid-fixing bath for lantern slides is made as follows (chemicals must be mixed in order given ONLY):

Sulphite of soda, ¼ ounce; dissolved in 1 ounce of water, and then add 30 drops of hydrochloric acid. Stir well. In a separate vessel, dissolve:

Hypo-sulphite of soda, 4 ounces, in 20 ounces of water. When the hypo is all dissolved, add the acidulated sulphite solution to the solution of hypo. (Not the reverse.) The whole being gently stirred during the mixing.

804. Alum.— Alum is frequently employed for the purpose of hardening the film, especially in hot weather, but its use is attended with considerable danger to the negatives, as alum and hypo mutually decompose each other with the production of new substances, which endangers the natural life of the negative. If used as given in our acid chrome-alum fixing bath it is all right.

805. Formaline.— Formaline, or Formaldehyde, is a gas which dissolves to a large extent in water. A solution of the strength of forty per cent. is sold commercially. This liquid diluted with from ten (10) to twenty (20) parts of water (1 ounce to 20 ounces), makes a bath which may be used to harden the gelatine film, and is easily washed out and not likely to do any harm. After the plate is developed and then washed for two or three minutes, it is placed in the above mentioned solution (1 to 20) for three or four minutes. The plate should then be rinsed and placed in the hypo bath as usual. After fixing, the film will be found so tough and insoluble that the negative may actually be washed in water hotter than the hand can bear, without any sign of softening. Negatives so treated dry much more quickly than when treated otherwise. Plates slightly washed after fixing may be treated with Formaline (1 to 16)if preferred, and then washed as usual.

806. Washing After Fixing.— It is desirable that washing after fixing be quickly and thoroughly done. If running water be available, an hour is long enough; when the water supply is limited, the plate may be washed in a flat dish, frequently rocked, for five minutes or so; the water being then drained off and a fresh quantity added, and the process repeated until the plate has had a half to three-quarters of an hour washing. When left to wash in running water, it is

better for the plate to be placed vertically in a grooved box than to lie in a flat dish, thereby avoiding any sediment which is likely to settle on and stick to the soft gelatine surface. When a plate has been sufficiently washed, it is well to hold it (face upward) under the tap of running water and lightly wipe over the surface with a pad of filter cotton, in order to remove any sediment which may have settled on the film from the washing water. To prevent sand or rust from striking the negatives while washing them, tie a piece of cotton flannel over the faucet.

807. Drying the Negatives.— Plates are best dried in a moderately warm room, the temperature of which should not vary much, with good ventilation. They should not be placed too close together. A plate must never be laid in the sunlight to dry, as this may melt the film, cause transparent holes, and, if nothing worse, will increase the intensity. In cold weather do not allow the negative to get too cold while drying; this not only retards the drying, but in case the moisture therein should freeze, it will cause mottled spots. If the negative is partly dry and then removed to another room which is much warmer or colder, it will cause a difference in the intensity of the part to dry last. If a negative be wanted in a hurry, it may be quickly dried by laying it for ten minutes (*after thoroughly washing*) in a bath of alcohol, then it will dry rapidly. If dried in this way the negative must first be very thoroughly washed, for if any hypo be left in the film, an insoluble white deposit may be formed, which cannot afterwards be removed.

808. Halation.— Halation is the spreading of the strong lights of a negative and consequent encroachment upon the shadows. In a view negative including a bright sky it is generally found, on development, that the extreme edge of the plate above the sky, which was protected by the rebate of the dark slide, does not remain clear, although the other three edges may do so, the strong light of the sky having spread beyond its proper boundary. When a picture is taken of the dark interior of a building including a window, the

light of the latter often seems to spread and form a wide blur all around. (Can be remedied by local reduction.)

In the ordinary negative the effect of halation is scarcely apparent; but, nevertheless, it is there more or less generally, and is detrimental to the fine details. Halation is due chiefly to light which has passed through the film and been reflected from the back surface of the glass plate. It is also, to a minor extent, caused by a lateral spreading of light from particle to particle of the silver bromide in the film. Some plates are more liable to halation than others; this depending on the opacity and other characteristics of the film. The *Hammer Plates*, even when not backed, are notably free from it; but the *Hammer Aurora Double-Coated* (Non-Halation) *Plate* is prepared especially to prevent halation. We recommend their use, especially for interiors, landscapes and marine views, as well as for groups and white draperies. Expose for the darkest shadows and use a rather dilute developer.

809. We also furnish a backing, "Acme Halation Destroyers," which is a good article for sticking in optical contact with the glass. It helps to overcome the halation effect. We also furnish plates backed with this medium when so ordered.

## ORTHOCHROMATIC SCREENS AND PLATES.

810. A general misconception still prevails concerning the use of Orthochromatic Plates with or without a screen.

The relative brightness of the colors of an object as represented in an ordinary photograph is very different from the relative brightness of the same colors as seen by the eye. This is due to the fact that all photographic plates including the very best of the so-called Orthochromatic (Hammer's), are enormously more sensitive to the blue and violet than to red, yellow and green.

In the early days of these plates, some persons had the idea that Ortho plates could not be used at all without a screen — try a few and see.

There is some advantage with Orthochromatic Plates in color rendering without the screen, if the violet and blue do

not predominate. All plates have excessive sensitiveness for violet and blue. Orthochromatic Plates show this tendency also. The use of the screen is to cut off the excess of the actinic light.

A screen gives better rendering of gradation, but it prolongs the exposure. If, however, the conditions under which the photograph is taken demand a short exposure, the screen may be abandoned.

Much has been said about adjusting the screen to the color sensitiveness of the plate; of course, this is important in such exact work as three-color printing necessitates, but with landscape and all ordinary objects that are to be photographed, less exactitude is permissible.

## HAMMER'S ORTHOCHROMATIC PLATES.

(*Three Grades.*)

SLOW — EXTRA FAST — NON-HALATION.

811. The product of years of chemical research, which have produced a plate that is sensitive to orange, yellow, green and the ordinary reds.

812. These plates have been much improved within the last year. Their color sensitiveness has been greatly increased.

813. The value of this special sensitiveness is very apparent. In view work, where there are clouds and colored foliage, or work embracing great distance, the finer details are retained. Draperies are reproduced in their true color values. Auburn hair will not be reproduced as though it were black. Freckles are less noticeable. Blue eyes will not be reproduced as almost white.

814. The day is not far distant when nearly all of the plates used will be color sensitive.

815. The Extra Fast Orthochromatic is slightly faster than the regular Extra Fast Plate.

816. The Non-Halation Orthochromatic combines all the advantages of a double-coated plate with those of the color sensitive plate, and is an exceptionally good plate.

817. The Slow Orthochromatic has a high degree of color sensitiveness, and we recommend it for use where time can be given.

818. In bright light a yellow screen is an advantage.

819. We make a Special Red sensitive Plate to order which is sensitive to the entire spectrum, and must be handled with great care; this plate is for three-color work.

### HAMMER'S SPECIAL EXTRA FAST.

820. There being a limited demand in exceptional cases for a plate that is still faster than our Extra Fast, we have placed this Special Plate on the market to meet this demand.

821. This plate is of special use during the dark winter months, and for objects where the shortest exposure possible must be given.

822. They are invaluable for flash-light exposures, extremely short snap-shot exposures, etc.

823. In the Hammer Special we retain the fine grain of the slower plates, even with this extreme rapidity.

824. In all ordinary cases our Regular Extra Fast Plate will be found rapid enough for all requirements, but we offer this Special Plate for special cases where nothing else will do.

### HAMMER'S X-RAY PLATES.

825. In order to get the best results in this kind of work, it is necessary to have a specially prepared plate and a specially prepared developer.

826. Our X-Ray Plates ($\frac{1}{2}$ dozen in a box) are packed in envelopes made of chemically pure paper.

827. All plates must be kept well out of range of the X-Rays, or they will be ruined.

### HAMMER'S (DRY POWDER) X-RAY DEVELOPER.

828. This preparation is for the development of Hammer X-Ray Plates that have received X-Ray exposures.

829. It works rather slowly, but allows shorter exposure of the plate and will give a negative of more intensity and

without sacrifice of the shadows, than will a developer made by any other formula.

830. This developer should not be used for ordinary photographic plates.

### HAMMER'S EXTRA FAST PLATES.

831. Specially adapted for use in the studio, for general photographic work where short exposures are necessary, also for the hand camera and instantaneous exposures.

832. The *Hammer plates* do not require as strong a developer as that generally recommended for other plates.

833. Consequently the best results are obtained by using our formulæ, as published. If more delicate effects are desired, add more water in diluting the developer for use; it causes a little slower development, but its advantage will be seen in the finished negative.

### HAMMER'S FAST PLATES.

834. This brand of plates is intermediate in rapidity, between Hammer's Slow and Hammer's Extra Fast, combining the great latitude of the Slow Plate with enough rapidity for all ordinary purposes, except where a very short exposure is required or the light is not good.

835. A large number of photographers use this plate for view work, while many commercial workmen prefer it to all others. The grain is fine and the latitude good. Any degree of softness or contrast may be produced on this plate, by noting the principle mentioned in the article about Slow Plates.

836. If the Slow Plate is too slow and the Extra Fast is too rapid, then this is the plate that you want — easy to work and an ideal plate, unless you wish to make snap-shots, in which case see article regarding Hammer's Extra Fast.

837. For the benefit of the beginner, we give a table showing the approximate exposure required on Hammer's Extra Fast Plates, on various subjects and in lights of various strength. This is (10 a. m. to 2 p. m.) in May, June and

July. In other months (and earlier and later in the day) the light is not so strong.

838. Of course, the temperature of the developer and the quality of the lens bring in variations that we have not space to consider here, but we wish to give some idea about the exposure required on different subjects under various conditions of light. (Use No. 8 diaphragm.)

839. With the Orthochromatic Extra Fast Plate, without a screen or a ray filter, the exposure is the same as given below. If a screen or a ray filter is used the exposure will have to be increased from four to eight times, according to the darkness of the filter.

840.

| Exposure Table for Hammer Extra Fast Plates, in | Intense Sun | Bright | Hazy | Dull | Very Dull |
|---|---|---|---|---|---|
| Subject — | Part of a Second | | | | |
| Clouds | 1-800 | 1-500 | 1-400 | 1-250 | 1-200 |
| Snow, sea and sky — distant view | 1-400 | 1-250 | 1-200 | 1-125 | 1-100 |
| Semi-distant views and light objects | 1-200 | 1-125 | 1-100 | 1-64 | 1-50 |
| Average scenes, near views and buildings | 1-100 | 1-64 | 1-50 | 1-32 | 1-25 |
| Groups, dark objects, portrait — out-of-doors | 1-50 | 1-32 | 1-25 | 1-16 | 1-12 |
| Views — heavy foliage in foreground | 1-25 | 1-16 | 1-12 | 1-8 | 1-4 |
| Wood and badly-lighted river banks | 1-10 | 1-8 | 1-6 | 1-4 | 1-2 |

## HAMMER'S SLOW PLATES.

841. This brand of plates allows great latitude in the exposure; has exceptionally fine grain, and is what its name implies — Slow, being about one-fourth the rapidity of Hammer's Extra Fast Plate.

842. It is just the right rapidity and quality for view work, where there are no moving objects, such as the ordinary views that are taken by professional and amateur photographers.

843. This plate is extensively used:

*For copying*
*For process work*
*For button work*
*For commercial work*

and any photographic work that does not require a short exposure.

844. These plates, when developed with a normal developer and the development carried reasonably far, will give strong negatives with clear shadows.

845. But if a dilute developer is used, one can get a fine soft chemical effect.

## HAMMER'S LANTERN SLIDE PLATES.

846. These plates are suitable for making slides either by contact or reduction.

847. These plates are coated on glass specially made for this purpose, which is thin and free from defects. The ordinary negative glass, although excellent for the purpose, is not suitable for a lantern slide, as a defect that is too small to be detected by the eye will be very noticeable when enlarged by the lantern.

848. Many of our novice friends make positives from their negatives on these plates, as they reproduce all there is in the negative; nothing is lost as is the case with paper prints.

849. Our lantern emulsion is a model for fine grain, clearness and freedom from defects in general.

850. This plate will give rich, warm tones, or engraving black at will, with absolute clear glass effect in the high-lights.

851. Slides that are to be shown with a very strong light —electric oxy-hydrogen — should be made more dense than those to be shown with an oil light.

## HAMMER'S TRANSPARENCY PLATES.

(*The Ideal Pictures.*)

852. Are specially prepared of a slow fine grain emulsion, giving clear glass effect for the highlights and crisp, brilliant shadows of ideal gradation, producing the very finest positives on glass.

853. A fine positive on glass, such as can be made on Hammer's Transparency Plates, reproduces all that there is in the negative; nothing is lost, as in the case when paper prints are made. These plates may be used for contact work, the same as in using developing paper; using a plate the same size as the original negative, or, by using a mask of the black paper, a larger or smaller plate may be used.

854. By using the enlarging camera one can take their small negatives and produce a large transparency of almost any size.

855. These plates are used quite extensively for this purpose, but as their advantages become more generally known, the demand for them continues to increase.

856. Made in all shapes and sizes.

Odd sizes made to order.

857. These plates are about four times the rapidity of the Hammer Lantern Slide Plates.

858. Coated on specially selected glass.

## HAMMER'S NON-HALATION.

*Is a Double-Coated Plate.*

859. The cleaned glass is first coated with our Slow emulsion and dried as usual; then each plate is examined for any possible defects. The perfect plates are returned to the coating-room, and there receive a second coating, but this time it is of our regular Extra Fast emulsion. They are then returned to the drying-room, dried, and the next day again examined. Those having no defects are then packed for the market.

860. One can readily see the immense advantage this plate has over a single-coated plate for general work as where great contrasts are to be photographed.

861. Expose (time) for the shadows, time the exposure for the outer film; the under or slow film will take care of the high-lights. To get the best results these Non-Halation plates should be developed with a rather dilute developer—give the under film a chance to show its quality. Fix, and wash a little longer than usual.

## WEIGHTS AND MEASURES

*Fluid Measure.*

862.

60 minims .....1 fluid drachm
8 drachm.....1 ounce
16 ounces .....1 pint
8 pints .....1 gallon

All chemicals are usually sold by avoirdupois weight, in which there are 437½ grains to the ounce, and 16 ounces to the pound. This is the ounce used in all of our published formulæ.

863. Stripping Film.

**(Removing film quickly from glass.)**

A

Sodium Fluoride .....6 grains
Water .....4 ounces

B

Sulphuric Acid .....6 drops
Water .....1 ounce

Both solutions can be used until exhausted. Place the negatives in solution A for a couple of minutes, and then place directly in solution B. After another couple of minutes raise the film with the finger from one corner; it will soon leave the glass. Very good in the case of broken negatives, for transferring the film onto another glass. In this case place the negative (before stripping) in a chrome-alum bath, made up 1 ounce chrome-alum and 20 ounces water, for one-half hour. Then wash well and proceed to strip. (Another satisfactory method is given in Vol. X, page 331.)

## CHAPTER XXII.

### Wet Plate Process.

864 Following closely on the heels of the earliest method of taking portrait photographs—that is, on a silver plate by the Daguerrean process—came the discovery of the use of collodion as a transparent vehicle for holding the salts sensitive to light. The Daguerreotype had the disadvantage that the image was reversed (although a positive) and was not reproducible, so was speedily displaced by the newly discovered wet collodion process, which gave results equal in fineness and gradation to any produced by the modern dry plates. It was styled the wet plate process, because it had to be used in a wet, freshly-prepared condition to retain its sensitiveness. It was not until some time later that a dry sensitive collodion emulsion was devised, and this again was speedily displaced by the gelatin emulsion of the dry plate as we know it today.

865. The original method of the wet plate process was to flow a collodion film containing metallic iodides on a sheet of glass, and then to sensitize the film in a solution of nitrate of silver. This formed iodide of silver salts, which were more sensitive than nitrate of silver salts. The exposure was made while the plate was still wet from immersion in the silver bath, and then developed in a solution of pyrogallic and acetic acids, being subsequently fixed in hypo. This process is essentially the same as the wet plate process still in use.

866. **Application of Wet Plate Process.**—While the wet plate process is not a difficult one, yet for studio and general photographic work it has outgrown its usefulness. However, there are special departments of photography

for which the wet plate is indispensable and is better adapted than its rival, the dry plate. For instance, for the photographing of large drawings, maps, etc., the wet plate gives the best results both on account of its greater economy when large plates are used and because clear lines and dense backgrounds can readily be obtained. This process is, therefore, principally employed by the government, where thousands of maps and drawings are to be reproduced, and in large commercial studios where similar work must be reproduced.

867. The wet plate process is also used for certain kinds of technical work, such as the making of negatives for process work for photo-engraving, etc. It is also used in making enlarged negatives, lantern-slides, and for microscopic work. For the latter mentioned purposes it has two distinct advantages over the modern dry plates—first, its cheapness, and second, the possibilities of obtaining greater density of deposit, together with the extreme clearness of shadows. Still another reason, more especially for microscopic and lantern-slide work, is the possibility of producing the extremely fine grain, which is an advantage where fine detail is required.

868. The manufacturers of the dry plate of today are endeavoring to imitate the qualities of the wet plate, and in many instances they have met with success; but, owing to the difference in expense between the two, the wet plate will always hold its own for commercial purposes.

869. In the early days of the wet plate process, the photographer was not only compelled to prepare his own collodion, but also the pyroxyline (gun-cotton) from which the collodion was made. Today, however, collodion can be purchased already prepared for use, and while large consumers of collodion prepare their own chemicals, yet the making of gun-cotton has been dispensed with and this product is bought ready for use from the supply dealers.

870. **Dark-Room.**—The first requirement for the wet plate process is the dark-room. While any ordinary photographic dark-room will do, yet, as the wet plate is less

sensitive to light than the modern dry plate, a much stronger light may be employed for manipulation of the wet plate than would be safe to use for the dry plate. A light which would be sufficiently safe for the development of bromide papers would be perfectly safe for the manipulation of the wet plate. Usually, one thickness of post-office paper over an ordinary light will be found perfectly safe. The yellow or amber color will be found better than the ruby light. While a less diffused light may be employed for the manipulation of the wet plate, a dark-room absolutely free from white or actinic light must be used.

871. **Dark-Room Equipment.**—The dark-room should be equipped with a sink of sufficient size to allow of plenty of room for the developing directly over the sink. At one end of the sink you should prepare a place to receive the silver bath. This bath should be so located as to project only a trifle above the top of the sink itself. The top of the bench on which the silver bath rests should be covered with blotting paper, to take up and absorb any of the drippings that may fall from the wet plate coming direct from the silver bath.

872. For experimental purposes and small work, such as the making of lantern-slides, etc., one may use an ordinary clean tray for sensitizing the plate, but this will not prove very convenient, as a clip or dipper of some kind should be employed for the handling of the plate. The fingers must not come in contact with the silver solution, as this will stain them black on exposure to light; therefore, the regular silver bath dish with dipper for handling the plate is recommended.

873. At the opposite end of the sink you should have your fixing bath arranged in the same manner as the silver sensitizing bath. Each bath should be provided with a rubber dipper, upon which the plate is placed and carried to and from the bath. A shelf should be placed directly over the sink for holding the collodion bottles, also your developing and sensitizing solutions.

874. **Chemicals Required.**—You will require negative

collodion, a silver sensitizing bath, fixing bath, developer, also intensifying and reducing chemicals.

875. **Apparatus Required.**—While the apparatus for the wet plate process is practically the same as that used for the dry plate, yet there are a few additional important parts necessary. The lens, camera and camera-stand may be the same as for the dry plate, yet the plate-holder for the camera is slightly different in construction. The curtain-slide, or what is usually styled the Benster plate-holder, is used; but, owing to the fact that there are some drippings of silver from the wet plate, which would drop onto the wooden guides of the plate-holder and very soon corrode them, special silver posts are used in the guides, and in addition to these silver posts, on the bottom guide there is attached a glass trough to catch the silver drippings from the plate. Aside from this the plate-holder is exactly the same as that used for the dry plate.

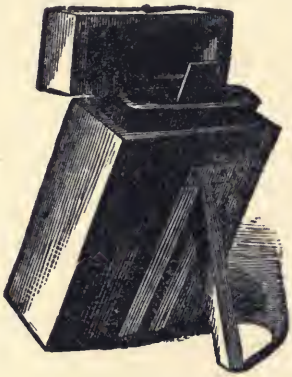

Illustration No. 28
Silver Bath
See Paragraph 876

876. In addition to the plate-holder, two large glass bath receptacles will be necessary, one to be used for your silver sensitizing bath and the other for your fixing bath. While you may construct such a bath dish, it is much cheaper in the end to purchase the regular vertical glass baths made especially for this purpose, which can be ob-

tained from any photographic supply house (See Illustration No. 28.) These glass baths should be large enough to hold the largest plate that you will use. They are manufactured in regular sizes from 5 x 7 to 21 x 26 and are furnished fitted in a wooden box, or without, just as you desire. The most convenient bath is that furnished with a wooden box having a hinged cover, thus enabling you to keep your bath covered at all times, free from dust.

877. **Dippers.**—For the purpose of lowering the plate into the silver bath, or into the fixing bath, you should provide yourself with two hard rubber dippers. These are so arranged that the plate rests on the small tips attached to the bottom of the dipper. There is still another style of dipper, made of German silver, which will answer every purpose, but it is not generally in use in this country.

878. **Bottles.**—You should provide yourself with a number of bottles large enough to hold the contents of your silver bath. Two or three of these bottles should be kept on hand, and two silver baths should be prepared—one being placed in the sun while the other is in use. The object of sunning the bath will be more fully described in a later chapter.

879. Besides the large bottles for the silver bath, you should provide a few bottles for your collodion, also for the developer. Collodion bottles should be provided with small necks, permitting of as little area as possible for exposure to the air when the stopper is removed. A small-necked bottle is also more convenient for use in flowing the plate. The developer bottle should be wide-mouthed. The bulk of your stock solution should be kept in very large bottles, while the developer ready for use may be kept in smaller bottles. Bottles should also be provided for your intensifying and reducing solutions.

880. **Glass.**—A good quality of sheet glass, carefully selected, free from bubbles, scratches and other defects, will answer for the smaller sizes. For large sizes and important work, either flat crown or patent plate-glass should be used. The former is preferable.

881. **Negative Collodion.**—In preparing the negative collodion, we generally divide the process into two sections. First, we prepare what is known as plain collodion, which is made up of ether, alcohol and negative cotton (gun-cotton). The plain collodion alone is not suitable for negative work, but it must be iodized before it is ready for use. The object of the distinction between plain collodion and iodized collodion is as follows:

882. Where much use is made of the wet plate process, and special results are required for different kinds of work, the formula for the collodion requires changing. In some cases more detail is required, in others more contrast is necessary; consequently, this altering may be done in the iodizing of the collodion. Many commercial users prepare their plain collodion in large quantities and then iodize portions of it for different purposes, and place each in a separate bottle; in consequence, they have different formulæ to be used on different classes of work—thus the object of the terms *plain collodion* and *iodized collodion.*

883. **Formula for Negative Collodion.**—Note: For the convenience of the beginner, in the following formula we supply a quantity of 20 ounces of collodion. Any larger or smaller quantity may be prepared in the same proportions:

884. **Plain Collodion.**—

| | |
|---|---|
| Alcohol | 10 ozs. |
| Ether | 10 ozs. |
| Gun Cotton (Neg. Cotton) | 120 grs. |

885. **Preparing the Plain Collodion.**—A simple method for preparing the collodion is as follows: Dissolve 6 grains of gun-cotton (negative cotton) to every ounce of equal quantities of alcohol and ether. In preparing the above formula for 20 ounces of collodion you would proceed as follows:

886. Place in a 32-ounce narrow-necked bottle, 120 grains of negative cotton. It will be found necessary to pull the cotton in small threads in order to insert it in

the narrow neck of the bottle. After all the cotton has been placed in the bottle, add 10 ounces of alcohol and 10 ounces of ether. Shake until the cotton is entirely dissolved. This constitutes your plain collodion.

887. **Iodizing the Collodion.**—The collodion is iodized by adding to the above plain collodion solution:

Iodide of Cadmium .....10 grs.
Iodide of Ammonium .....60 grs.
Bromide of Ammonium .....30 grs.

Shake until all ingredients are dissolved. The collodion works best when allowed to stand for a day to ripen before use.

888. It may become necessary at times to change the proportion slightly. For example, in cold weather you may slightly increase the ether and proportionately decrease the alcohol. By changing the proportions of iodide and bromide more density or more detail may be produced —less bromide will give more contrast, more bromide will give more detail, etc.

889. **Preparing the Silver Sensitizing Bath.**—The preparation of the silver bath is, practically speaking, a very simple matter, yet there are certain points which are important and must be remembered. The bath must be either neutral or acid, *never* alkaline, and the amount of acidity or neutrality is governed entirely by the compound used in forming the collodion. For example: If iodide alone is used, so that the collodion is simply an iodized collodion and the sensitive salt in the film consists wholly of silver iodide, then the bath may be in a neutral state. If the collodion has been bromo-iodized according to the formula given above, the bath must be slightly acid. It is advisable for the beginner to use the bromo-iodized bath, as given above, and prepare the sensitizing silver bath acid, using nitric acid, C. P., for the purpose. Nitric acid will prevent spontaneous or independent reduction of the silver, thus keeping the shadows clear and free from chemical fog.

890. The quantity of silver solution to be prepared

will depend entirely upon the size negatives to be made; in other words, prepare sufficient to fill the glass receptacle in which the plates are to be sensitized. The following formula will be found to give excellent results and will make sufficient solution to cover an 8 x 10 plate:

Pure Nitrate of Silver, crystals .....6 ozs.
Distilled Water .....80 fluid ozs.
Nitric Acid, C. P. .....8 minims.

891. **Strength of Silver Bath.**—The proper strength of the silver bath should be anywhere from 45 to 50 grains of silver to the ounce of solution. The simplest method for testing the bath is with the hydrometer, which will give you an accurate test of your solution. When the bath falls below 45° the strength should be increased by the addition of a few grains of nitrate of silver crystals until it registers the proper strength. Should it be too strong, it may be diluted by the addition of distilled water until it tests the required strength.

892. **Iodizing the Silver Bath.**—All fresh made silver baths will require iodizing before use, otherwise they will produce fog in the negative. To iodize a bath proceed as follows:

893. Flow a glass plate with the regular iodized collodion, place it in the silver bath, and allow it to remain there for several hours. No harm will be done to allow it to remain over night in the bath.

894. **Testing Bath.**—After the bath is iodized it should be tested with blue litmus paper, which paper should turn red almost instantly upon entering the bath. With the bath testing acid being iodized with the collodionized plate, it should then be filtered ready for use. A simple way to filter the bath would be to prepare a large, clean bottle. Place a piece of absorbent cotton in a glass funnel, first wetting the cotton with distilled water. Place the funnel in the bottle and pour the silver bath into the funnel, allowing it to filter slowly into the large bottle; then rinse out your silver bath dish, to receive the filtered

solution. After all the solution is filtered into the bottle transfer the solution into the silver bath, when it is ready for use.

895. **The Developer.**—For the developing of the wet plate numerous developers are used. These, however, unlike the developers for the modern dry plate, contain no accelerator, but work in an acid state. They consist merely of a reducer dissolved in water. In order to get the developer flowing evenly it is sometimes necessary to add a small quantity of alcohol.

896. **Formula for Developer.**—

| | |
|---|---|
| Ferrous Sulphate | 2 ozs. |
| Restrainer (glacial acetic acid) | 1 oz. |
| Water | 40 ozs. |

Alcohol in sufficient quantity to make the solution flow freely. Usually ½ ounce is sufficient.

897. **Another Good Developer.**—

| | |
|---|---|
| Ammonium Sulphate of Iron | 1¼ ozs. |
| Glacial Acetic Acid | 1¼ ozs. |
| Water | 32 ozs. |
| Alcohol | 2 ozs. |

**Note.**—The formula for this developer calls for small quantities only when preparing your developer. However, a gallon or more should be made up at a time and prepared in the above proportions. The amounts given in the formula will be sufficient for experimental purposes.

898. **Fixing Bath.**—The fixing bath is composed of cyanide of potassium in approximately the following proportions:

| | |
|---|---|
| Cyanide of Potassium | 1 oz. |
| Water | 30 ozs. |

899. **Caution.**—Cyanide of potassium is a deadly poison. Both the bottle containing the cyanide crystals and the cyanide solution should be labeled and kept out of reach of children. Where the hands are scratched or contain any sores, they must never come in contact with cyanide, otherwise the system might become poisoned. Extreme care must be used in handling the plate in this

bath, and the fingers should be kept from the solution by using a rubber, glass or silver dipper.

900. In place of cyanide of potassium, the following formula can be used for fixing:

| | |
|---|---|
| Hyposulphite of Soda | 5 ozs. |
| Water | 30 ozs. |

901. **Washing Glass to be Used for Negatives.**—In order that you may be sure that the glass employed is chemically clean, place it in a solution of caustic soda or potash, for say five minutes. When the glass is coated with film—possibly an old exposed negative—it must remain in the potash for a number of hours, and for this purpose you should have an earthen dish or a solid rubber tray, one large enough to receive a number of plates at one time.

902. Another method for cleaning old dry plates for wet plate work, is to make up a strong solution of commercial sulphuric acid, placing the plates in this solution. It is advisable to wear rubber gloves when handling the plates. Where perfectly clear glass is used, a few minutes' soaking in the soda or potash will be found sufficient. After the plates have become thoroughly rinsed and cleansed, whether old or new, they should then be placed in a 10% solution of commercial nitric acid and allowed to remain for about an hour; finally, carefully rinse and set in the negative rack to dry.

903. **Preparing the Plate to Receive the Collodion.**—When dry, the plate is usually ready to receive the collodion; but, while the collodion may be applied direct to the glass plate without any previous preparation, there are cases where the collodion will not readily adhere to the plate. Should you meet with such difficulty it will be advisable to prepare the plate with albumen before collodionizing it.

904. **Albumenizing the Plate.**—Prepare the albumen as follows: Place into a clean dish 32 ounces of pure water. Add to this the white of one egg. Beat the egg well, mixing it with the water. Then add 10 to 15

drops of aqua ammonia, and again stir well; then filter into a clean bottle. To albumenize the plate you flow the albumen on the plate exactly the same as you collodionize it. (See Paragraph 906.) The plates are, of course, thoroughly cleansed and dried before this is done, and just before the albumen is applied the plate is carefully dusted with a camel's-hair duster. A sufficient number of plates for a day's work may be albumenized at one time, and after albumenizing they are placed in a rack to dry, in a place free from dust or fumes. The albumen must be thoroughly dry before applying the collodion. It is advisable to try collodionizing the plate without albumenizing it. Should the film slide or break from the plate you should apply the substratum coating (albumen) to another sheet of glass, then collodionize it.

905. **Collodionizing or Coating the Plate.**— Assuming that the collodion has been prepared properly and has had an opportunity to ripen, that the silver bath has been made up according to instructions, and that the plates have been washed and dried ready for flowing on the collodion, you first take a plate from the rack, examine it and see which is the concave and which the convex side. This you can judge by placing the plate in such a manner that you can sight along its edge. The side which curves upward is the concave, and this is the side which should be coated. Catch the plate, by the lower left-hand corner, between the first and second fingers of your left hand, allowing the extreme corner to rest against the thumb. In this way you will have a firm hold of the plate and can tip it to any angle and in any manner you desire.

906. Another method is to place the plate on the tips of the fingers and thumb, separating the fingers slightly so the plate will be well balanced on the hand. Next, carefully dust the plate with a camel's-hair brush; then with your right hand take up your collodion bottle and pour a small pool of collodion on the center of the upper part of the plate. Tip the plate a trifle, flowing the collodion to the top right-hand corner, then to the top left-hand corner,

next to the bottom left-hand corner, and finally to the bottom right-hand corner. The excess collodion should then be drained carefully back into the bottle. As soon as the plate has ceased to drip, replace the stopper in the collodion bottle. The collodion bottle must always be kept tightly stoppered when not in use, as the ether in the collodion will evaporate rapidly if left uncorked and the collodion would soon become thick and worthless.

907. When flowing the plate with collodion, exercise care that you have a clean sweep of the collodion over the entire plate. Should any portions receive a double coating, waves and streaks would be caused in the negative. Beginners are liable to permit the collodion to run over the back of the plate. With a little practice, however, working carefully and not using too much of the collodion, you will very soon be able to coat a plate properly.

908. In cold weather you will find that the collodion will set much slower than in the summer or warm weather. When there is an even dullness over the entire surface of the plate, which usually requires but half a minute, you can be certain that the coating is set and the plate is ready for the silver sensitizing bath. If you are at all in doubt, gently touch the corner of the plate, from which the collodion was drained, with the tip of the finger. If it shows signs of tackiness it is properly set. This test is usually unnecessary, as you will soon be able to judge by the appearance of the collodion on the surface.

909. **Placing the Plate in the Silver Bath.**—All the previous operations may have been performed while the dark-room door was open, using plenty of light. At this stage, however (placing the plate in the silver bath), it is advisable to close the dark-room door, for while the plate is not sensitive to light until after it has entered the silver bath, yet, unless the location of the silver bath is sufficiently far from the door, the light might affect the quality of the plate; therefore, to insure safety close the door while immersing the plate. Place the plate firmly on the tips of the dipper and gently lower it with one continuous sweep

into the silver bath. If you were to immerse a part of the plate and then stop for only part of a second before continuing the immersion, the plate would be liable to bear a line or mark across it at that place.

910. After the plate is fully immersed, it is advisable to raise and lower it a few times in the solution. This enables the solution to penetrate the film more readily, also removes the ether from the surface, and the action of the sensitizer becomes even. The plate should remain in this bath for about six minutes. The exact time, however, is governed by the temperature and the nature of the sensitizer employed. Usually, the higher the temperature the shorter the duration of the plate in the bath; therefore, in summer months, or in hot climates, two-thirds of the time required for winter months or cold climates will be necessary.

911. The single iodized collodion requires less time for immersion than where the collodion has been bromo-iodized, the latter of which is the method recommended herein. In the latter case it will generally require five to six minutes, while in the former, three minutes will be sufficient. The proper immersion can be judged from the appearance of the plate. If it appears at all wavy or oily on the surface, the plate has not been sufficiently immersed and must remain until this appearance takes place. Of course, the plate must be examined by the yellow light and not by daylight.

912. **Loading the Plate-Holder.**—The wet plate, as its name implies, must be exposed while in its wet condition. After the plate has been in the silver bath a sufficient length of time, it is ready to be placed in the holder. Draw the plate from the bath slowly and carefully, slightly tilting it to one side, thus permitting the excess silver to drain back into the bath; then, catching the plate by two opposite corners, place it into the plate-holder in the usual way, when it is ready to be exposed.

913. **Exposing the Plate.**—Having focused on the ground-glass the object which you wish to photograph,

place the plate-holder in position, close the shutter and draw the slide. In order to test the rapidity of your bath, proceed in the following manner: Make a test by exposing two or three plates, ranging in time from ten to forty seconds. Keep a careful memorandum of each plate and exposure, and compare the results after developing. Remember that plates prepared with silver iodide may require twelve to twenty times the exposure of an ordinary dry plate, while those which have been prepared with bromo-iodide, or with collodion which is bromo-iodized, according to the formula described herein, will be much faster. One advantage of the wet plate, like the slow dry plate, is the great latitude of exposure allowable—you may over-expose considerably without any serious results.

914. **Caution.**—For the benefit of those unaccustomed to handling wet plates, but familiar with the handling of dry plates, we would advise never allow your fingers or anything else to come in contact with the coated side of the plate. The film is extremely tender, and even a strong flow of water will often destroy it completely.

915. **Developing the Plate.**—Into a graduate or large-mouthed bottle, pour sufficient developer to cover the entire plate—usually from three to five ounces being sufficient. Remove the plate from the holder and hold it by one corner with your left hand over the sink. With the developer in your right hand, flow the plate with a sweeping motion, spreading it over the entire plate in one operation. It is important that the entire plate be covered with one sweep. To do otherwise would give you streaks, and as the developing solution is inexpensive a liberal quantity should be employed. With a little practice you will be able to flow the plate successfully.

916. After the developer is flowed over the plate, slightly rock it backward and forward, thus keeping the developer in motion over the plate for twenty to thirty seconds. If the image flashes up quickly and is of an even gray color, you have over-exposed; but, on the contrary, if it builds up slowly or in black and white patches, you have under-ex-

posed. This is, of course, supposing that all previous operations have been properly carried out. The appearance of the properly exposed plate is similar to an ordinary dry plate which has been bleached in mercury. When viewed by transmitted light it is of a brownish color, and of a creamy color when examined by reflected light. Examine the plate for density by holding it before the orange light, and unless you have carried the developing far enough the plate will not appear sufficiently dense. Rinse the plate under the tap of running water and again flow with developer. With a little experience you will soon be able to judge the proper density to which the plate should be carried in the developing.

917. **Fixing the Plate.**—When the plate is completely developed, it is rinsed under the tap and then placed directly into the fixing bath. It must remain in this bath until all yellowness entirely disappears from the plate. Where potassium cyanide is used as the fixing agent, bear in mind, as previously stated, that this is a *deadly poison.* Do not allow it to come in contact with scratches or sores. The bath containing the cyanide should be kept closed, as the fumes from the cyanide are sometimes injurious to the health.

918. **Washing the Plate.**—After the plate is thoroughly fixed it can either be washed under the tap, by hand, for five or ten minutes, or placed in the regular washing box fifteen to twenty minutes. After washing, the plate is set in the negative rack to dry.

919. **Re-Developing.**—There are times, when using a newly prepared, or overworked, bath that the image does not develop up as strongly as you would like, with the result that the negative is weak. Such negatives can be improved very materially by re-development.

920. **The Re-Developing Solution.**—In a small bottle, prepare a 10% solution of nitrate of silver. Acidify this solution with a drop or two of nitric acid, C. P., or sufficient to instantly turn blue litmus paper red. Label this bottle, "Silver Stock Solution for Re-developing."

921. **Applying the Re-Developer.**—When developing the plate in the ordinary way, and after applying the developer, you find the plate still lacks strength, pour into your tumbler or a graduate, 4 or 5 ounces of your developer. Add to this about 10 drops of your silver re-developing solution to every ounce of developer and flow the plate with this combined developer. This re-developer will considerably increase both detail and density, and should only be used when the image from the first application of developer appears weak and lacking in detail. If, however, the negative is weak but has sufficient detail, intensification is necessary.

922. **Intensifying.**—Where the plate simply lacks in density, the image may be intensified by either of the following formulæ:

923. The first formula is made up of pyrogallic acid and the second of ferrous sulphate. We would recommend the second formula, although very good results can be obtained with either. The pyro intensifier will build up the image much more readily than the iron. This method, therefore, is more suitable for a negative which has been properly exposed, but possibly under-developed. The second formula is best applied on negatives which have been under-exposed, but fully developed.

**Formula No. 1.**

| | |
|---|---|
| Pyrogallic Acid | 40 grs. |
| Citric Acid | 50 grs. |
| Water | 20 ozs. |

**Formula No. 2.**

| | |
|---|---|
| Ferrous Sulphate | 120 grs. |
| Citric Acid | 240 grs. |
| Water | 20 ozs. |

924. Wash the plate thoroughly and flow the intensifying solution over it in the same manner as you flow the developer over the plate. Constantly rock the plate until you have produced sufficient density, after which it should be washed thoroughly.

925. Intensifying may be done before or after fixing.

If the plate is over-exposed it is advisable to intensify *after* fixing; if under-exposed, *before* fixing.

926. **Washing.**—After intensifying and fixing, the plate should be thoroughly washed in the usual manner. It may then be dried by holding over a gas or oil stove, or may be placed in a negative rack to dry. If drying is hastened by artificial means, the density of the negative will be slightly increased.

927. **Varnishing.**—The surface of the negative even when dry, is very easily marred or scratched, as the collodion film is extremely delicate. It is advisable, therefore, to coat it with some hardening substance in the form of a varnish. Regular negative varnish may be purchased ready for use from any photographic supply house, or you may prepare it yourself by dissolving one pound of seed-lac in a gallon of pure alcohol. This should be kept in a warm place, and it may require a number of days for it to dissolve. The bottle should be shaken occasionally. When the ingredient is dissolved, decant and filter.

928. **Varnishing the Plate.**—To varnish the negative grasp it firmly between the thumb and first and second fingers, in a similar manner to that described for flowing the plate with collodion. Hold the plate over a gas or oil stove until it becomes of a uniform blood-heat throughout; then apply the varnish in exactly the same manner as you did when coating the plate with collodion. Drain the superfluous varnish into another bottle. The object of draining into a separate bottle is, that particles of dust may collect while varnishing. If this dust were poured back into the stock bottle of varnish it would soon become charged with dirt; while if drained back into a separate bottle, after a sufficient amount of this varnish has accumulated it can be filtered and then added to the fresh stock, when it will be free from dust or dirt.

929. After the plate has been flowed with the varnish hold it over a gentle heat (not too close to it) until the back becomes uncomfortably hot. Keep the plate rocking so as to distribute the heat evenly throughout. To hold

the plate too near the heat or flame might result in the varnish catching fire. Should it by accident catch fire, blowing over the plate will extinguish the blaze. As before stated, there are many good varnishes on the market, some of which may be applied to the plate when cold. Others require the heating of the plate. Usually a method for applying the varnish accompanies each bottle. Should the varnish become thick from age, such varnish applied to the plate may cause the loss of definition and should not be used. Always dust the plate before varnishing it.

930. When using varnish which requires the negative to be warm when applied, should the varnish have an all-over frosted appearance, you will know that the plate has not been sufficiently heated. Should the varnish form ridges over the plate, you have not taken care to tip the plate in one direction only when varnishing. Never allow the varnish to run back over the surface which has previously been covered, but have the flow all in one direction and keep the varnish constantly moving. Never allow the body of the varnish to remain on one spot while flowing the plate. When the varnish is too thin and the plate too cold, you will produce a frosted surface. When it is too thick, it is liable to cause ridges.

931. **Keeping the Sensitizing Bath in Working Condition.**—From constant use the silver bath will in time become charged with soluble salts, resulting from the numerous collodionized plates which have been sensitized in this bath. It is advisable, therefore, to have two baths in working order, and while one bath is in use the second may be doctored and put in condition. Unless the bath has been worked hard, ordinarily pouring it into a large bottle and placing in the sun for a day or so will precipitate all the impurities. At the same time a certain amount of the solution will evaporate, and it will be necessary, therefore, to bring up the bath to its normal quantity by adding distilled water to the bath, after which it should be tested for strength and brought to the normal condition.

932. The sunning of the bath will also evaporate the excess ether which has accumulated from the collodion, and all organic matter will, as a rule, be precipitated to the bottom of the bath. Usually, the bath is again in condition for use after a good day's sunning. If the bath is very much overworked, however, it may have become seriously charged with organic matter. Under such conditions you will need to resort to the boiling of the bath. To do this pour the solution into an enamel or earthen dish and place over a lighted gas or oil stove. Before placing over the fire, however, first neutralize the bath—make it alkaline—by adding a few drops of ammonia, and test with red litmus paper. When the red litmus paper turns blue, the bath is alkaline and may be placed on the fire to boil. The object of neutralizing the bath is to precipitate all organic matter.

933. When the bath comes to a good boiling stage, you will find the color of the bath to be black and turbid. The heating will cause evaporation and when evaporated, or boiled down to about one-third its former quantity, remove it from the stove and allow to cool, then filter. Before filtering, however, you should test the bath with the hydrometer, when you will find it very strong, the strength being increased as the bulk of the bath decreases by evaporation. You will, therefore, need to add sufficient distilled water to bring it to its original quantity, then finally test with the hydrometer.

934. As a certain amount of silver is deposited upon each plate sensitized, the bath when brought back to its original quantity, naturally will be weaker and it will be necessary to add more nitrate of silver to bring it up to its normal strength. All this should be done before the bath is filtered.

935. **Fusing the Bath.**—There is still another method of doctoring a bath, which is termed *fusing*. This method is similar to the one just described, only that you carry the work farther. You continue the evaporation to dryness, allowing the bath to remain on the stove until all the frothi-

ness has disappeared. This process, however, is best done in an earthen dish, which can be purchased from any photographic supply house.

936. When the bath is brought to the proper stage and the frothiness has disappeared, remove it from the stove and gather the mass into a lump in the center of the dish; then apply to this a diluted solution of nitric acid prepared in the proportion of about 1 ounce nitric acid to 12 ounces of water, which will redissolve the silver. By placing the dish over the fire again the bath is once more evaporated to dryness, after which the sediment is dissolved in distilled water. Additional distilled water is then added until the bath is brought to its normal quantity and sufficient additional nitrate of silver crystals added to bring it to the proper strength. By this latter method all organic matter will have been thoroughly carbonized, and after acidifying the bath with a few drops of nitric acid and testing with blue litmus paper it is again in good condition for use.

937. **Special Formula. Negative Collodion. Good for Ferrotypes also.—**

| | |
|---|---|
| Alcohol | 5 ozs. |
| Ether | 10 ozs. |
| Negative Cotton | 100 grs. |
| Alcohol | 5 ozs. |
| Iodide of Ammonium | 60 grs. |
| Iodide of Cadmium | 30 grs. |
| Bromide of Cadmium | 20 grs. |

Dissolve in the order given.

938. **Note.**—The salts used for collodion should keep and react neutral. Cadmium salts thicken the collodion; alkaline salts make it thinner. Three to four parts of iodine compound are generally taken to one or one and a half parts of bromine salts; 166 parts of iodide of potassium are equal to 186 parts of iodide of sodium, or 145 parts of iodide of ammonium, or 134 parts of iodide of lithium; 119 parts of bromide of potassium are equal to 139 parts of bromide of sodium, or 98 parts of bromide of ammonium, or 172 parts of bromide of cadmium. Calcium

salts work the slowest; cadmium the quickest, and are also the coarsest. Iodide of potassium soon discolors the collodion containing it, and does not keep well. Bromine and iodine make the collodion gelatinous. Excess of bromine gives a blue film, and iodine a gray film.

939. **Special Developer for Negatives.—**

| | |
|---|---|
| Protosulphate of Iron (saturated solution) | 2 ozs. |
| Acetic Acid | 1 oz. |
| Water | 20 ozs. |

940. **Negative Varnish.—**

| | |
|---|---|
| Alcohol | 60 ozs. |
| Sandarac | 10 ozs. |
| Camphor | 1 oz. |
| Castor Oil | 2 ozs. |
| Venetian Turpentine | 1 oz. |

941. **A Simple Negative Varnish.—**

| | |
|---|---|
| Sandarac | 2 ozs. |
| Venetian Turpentine | ½ oz. |
| Oil of Turpentine | 1 oz. |
| Alcohol (825) | 20 ozs. |

This varnish is of a pale color and gives a very hard film. The plate must be warmed previous to coating.

## CHAPTER XXIII.

### Difficulties—Wet Plate Process.

942. **Parts of the Film Leave the Plate.**—This is a certain sign that the collodion has not been sufficiently set before sensitizing, or if the collodion has been well set before sensitizing and the film still leaves the plate, try albumenizing the plate before flowing with the collodion. Be sure this albumen is thoroughly dry before you apply the collodion.

943. **Parts of the Film of the Plate Thicker than Others.**—This is a certain sign that the plate was not evenly flowed with collodion. Some portions may have been double-coated by tipping the plate so as to allow the collodion to flow back over the portions which were formerly coated.

944. **Parts of the Plate Apparently not in Contact.**—This would indicate that the plate was not thoroughly cleansed. Particles of old film may have been allowed to remain upon the plate. Where mercury was used for intensifying the old plate which you have washed and again used, unless the mercury is entirely eliminated in the washing this same trouble would appear. Nitric acid is the only chemical that will entirely eliminate these defects. To be absolutely certain of overcoming such defects the plate may be albumenized before collodionizing it, according to instructions given in the lesson. Dampness of the plate will give the effect of lack of contrast. Always examine the plate carefully before collodionizing and see that it is perfectly dry.

945. **Ridges in the Emulsion.**—This is generally caused from a collodion that is prepared too thick, but it may also be caused from a piece of bad glass with chipped edges, which will many times cause the collodion to clog and not sweep cleanly over the plate, resulting in furrows in the emulsion. The only remedy for the latter is not to use such plates. See that all glass has clear edges and is free from defects generally.

946. **Part of the Plate Thinner Coated than Others.**—This may be caused from using too thin a collodion; the upper portion of the plate being flowed first would then not receive as heavy a coating as the lower portion. It may also be due to an excess amount of alcohol, causing the plate to dry too rapidly, and as it would

naturally dry more rapidly at the top than at the bottom, it would give an uneven coating.

947. **Fine Net Work Markings Over the Film.**—This may be caused from too much bromide of cadmium or lack of sufficient alkali. Perhaps more ammonium iodide would rectify the defect.

948. **Weak Image in the Negative.**—This is probably due to lack of sufficient gun-cotton; the use of old gun-cotton will also produce this result.

949. **Straight Lines Across Plate After Sensitizing.**—This is evidently due to improper immersion in the silver bath. The plate was not lowered in the bath with one sweep, but, on the contrary, you halted for a second, when only a portion of the plate was immersed.

950. **Straight Perpendicular Lines.**—This may be caused by the bath becoming charged with alcohol liberated from the collodionized plates. Such a bath should be boiled down for an hour, when most of the alcohol will be driven off in vapor. After the bath becomes cool it may again be brought up to its normal bulk by the addition of more pure water, and after filtering it is again ready for use.

951. **Scum on the Film.**—This is usually caused by too strong a silver bath. Test the bath with the hydrometer. If it registers over 45° reduce with pure water. Sometimes the collodion may be too strongly bromo-iodized. In such a case, add a little plain collodion to the iodized collodion, which will overcome the difficulty.

952. The scum may also be formed on the wet negative, from a scum that sometimes collects on the surface of the sensitizing bath. In such a case, float a strip of tissue-paper over the bath. The scum will collect on the tissue and can be withdrawn. It may require two or three such applications to remove it entirely. By careful use of the bath, keeping the dark-room clean and free from dust, and the sensitizing bath dish always covered, you will seldom experience any trouble. When the trouble does appear it is almost certain that the bath has become contaminated, and the best thing to do is to give it a good sun bath, by pouring it into a bottle and placing it in the strong sunlight for a day or two. Before sunning, however, the bath should be made alkaline with carbonate of soda or a few drops of ammonia. A small quantity only will be required, and if not certain that it is alkaline test with red litmus paper. When this paper turns blue the bath is alkaline.

953. **Pin-Holes.**—These may be caused by dust on the plate while collodionizing it. They may also be caused by too much iodide in the collodion, and, sometimes, even an insufficient amount of iodide will produce pin-holes. If you are careful to prepare the

collodion according to formula, and procure C. P. fresh chemicals, you will not experience any trouble.

954. **Comet-Like Spots.**—These are sometimes caused by undissolved particles of gun-cotton in the collodion. They are also caused by rust from the water faucet. Always filter your fresh-made collodion, and it is also advisable to filter the water from the tap. A linen cloth placed over the mouth of the faucet will answer.

955. **Round Black Spots.**—These are usually caused by dust in the air. *Remedy:* Keep the dark-room closet free from dust of any kind.

956. **Contrasty Negatives.**—This may be due to too acid a silver bath. Either the bath when freshly made may have been too strongly acidified, or, if it works well when fresh, it may have become charged with acid by constant use. The iodide in the collodion will in time liberate the nitric acid in the film thus charging the bath with considerable of the acid, which may cause trouble. By occasionally testing the bath with litmus paper it may be kept at the right stage. If at any time it tests strongly acid, it may be slightly neutralized by the adding of a little carbonate of soda. It is advisable, after adding the soda, however, to sun the bath for a few hours, and again filter before using.

957. **Circular Marks on the Plate.**—This is usually caused from drops of silver on the back of the glass plate. To overcome this, either wipe off the back before placing in the holder, or it will be good practice to back up the plate with another plate stained a dark color. This will usually overcome such difficulty.

958. **Streaks in the Developed Plate.**—These may be caused by uneven flowing of the developer, or not flowing the plate with one sweep. If the plate is allowed to stand in the holder for some time before use, this will cause the upper portion to slightly dry out, and, therefore, the dry part will not develop as freely as the wet portion. Streaks may also be caused if, by accident, water was first poured over the plate in place of developer, and afterward the plate was flowed with the developer. The water coming in contact with the plate first will give the surface an oily appearance, which the developer cannot overcome; therefore, care must be exercised when working near the tap, that even a drop of water does not fall upon the plate before the developer has been applied.

959. **Fogged Plates.**—This you will find may come from any of the following causes: By over-exposure; by light entering the camera; by lack of sufficient acetic acid in the developer; or by the silver bath becoming alkaline. When such trouble presents itself it is advisable to first test your exposure. Prepare another plate and give less exposure than given the former. If the plate still appears fogged, examine the camera and plate-holder. See

that there is no trace of light entering. Should even slight cracks in the bellows, or a small hole in the plate-holder appear, these are sufficient to fog the plate, and you should at once repair them. Should the camera prove safe and light-tight, then test your silver bath with both red and blue litmus paper. Should the bath test neutral—if neither litmus papers turn from their original color—then you will know that the bath is at fault, as it should be worked acid. This may be accomplished by adding a few drops at a time of nitric acid C. P., stirring with a glass rod and testing with blue litmus paper. When the bath turns blue litmus paper red it is in proper shape and this difficulty will be overcome. If the bath is not at fault, then look to your developer. You may have omitted the acetic acid, or you may have added an insufficient amount. To test this, expose another plate and pour the regular portion of developer in a tumbler or graduate, adding to it a few drops of acetic acid; then develop the plate with this developer, when you will very likely find all traces of fog disappearing. Exercise care that there are no vapors, fumes from ammonia, or gas in the room, as these will affect the manipulation of the plates.

## CHAPTER XXIV.

### Wet Plate Photography for the Photo-Engraver.

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960. The "wet plate process" is the method used by the photo-engraver in making the negatives for half-tone and line engravings. It is not only the first part of the process, but is also one of its most important stages, and requires considerable judgment and skill to produce the "proper kind" of a negative.

961. While there are several different formulæ in use, it is only necessary for the student to acquire the knowledge of one of each of the different stages (the ones given in this article are amongst the easiest to use).

962. In the first place, the operator should learn to be very "clean" in all his work, and also be economical in the use of his chemicals (considerable money can be wasted in the misuse of chemicals), as not only must the negative be of good quality, but it must be *produced at a minimum cost.*

963. The formulæ for each of the parts and the order in which they are to be used are as follows:

964. **Preparation of the Glass.**—The glass—which should be carefully selected, and be perfectly flat and free from imperfections—is first immersed in a solution of nitric acid (commercial) for at least twelve hours, then taken out and thoroughly washed with a brush, under running water, next rinsed and flowed twice with a solution of albumen, and afterward placed in a rack to dry.

965. **Albumen Solution.**—The solution of albumen is

made from the white of one egg, 32 ounces of water, to which is added 10 drops of aqua ammonia. Flow as many plates as you desire with the albumen and place in the rack to dry, when they are ready for collodionizing.

966. **Collodionizing the Plate.**—After being thoroughly dried, the glass is now ready to be coated with the collodion solution, which is made differently for producing either half-tone or line work as follows:

967. **Collodion Solution for Half-Tone Work.**—

| | |
|---|---|
| Alcohol | 32 ozs. |
| Ether | 32 ozs. |
| Cotton (Negative) | 360 grs. |
| Iodide of Cadmium | 150 grs. |
| Iodide of Ammonium | 90 grs. |
| Chloride of Calcium | 30 grs. |
| Chloride of Strontium | 30 grs. |

968. **Collodion Solution for Line Work.**—

| | |
|---|---|
| Alcohol | 32 ozs. |
| Ether | 32 ozs. |
| Cadmium Bromide | 120 grs. |
| Iodide of Ammonium | 320 grs. |
| Negative-Cotton | 1 oz. |

969. The glass is now ready for the silver bath, which is made up as follows:

970. **Silver Bath.**—

| | |
|---|---|
| Silver Nitrate | 8 ozs. |
| Water (Distilled) | 120 ozs. |
| Iodide of Potassium | 10 grs. |

Nitric Acid (C. P.) about 15 drops, or enough to turn litmus paper slowly *red.* Then the bath should be carefully filtered. This should test 42° with the hydrometer.

971. Before making an exposure of a plate, other necessary solutions should be made up ready for use, as follows:

972. **Developer.**—

1 oz. Protosulphate of Iron dissolved in 20 ozs. of water.
Acetic Acid ..... 4 ozs.

This should test 20° with the hydrometer.

973. **Fixing Solution.—**

Potassium Cyanide .....1 oz.
Water .....18 ozs.

974. **No. 1 Intensifier.—**

4 ozs. Sulphate of Copper in 20 ozs. of water.
2 ozs. Bromide of Potassium in 20 ozs. of water.
Then mix together.

975. To "blacken" negatives made with this intensifier, use a solution of ½ ounce of silver mixed with 6 ounces of water.

976. **No. 2 Intensifier.—**

Bichloride of Mercury .....1½ ozs.
Water .....20 ozs.
Ammonium Chloride .....1 oz.

977. To "blacken" negatives made with this intensifier, use a solution of ½ pound sulphate of soda mixed with 32 ounces of water.

978. **Reducer.—**

Potassium Cyanide .....60 grs.
Water .....6 ozs.
Iodine Solution (made as follows).....10 drops.

979. **Iodine Solution.—**

Iodide of Potassium .....1¼ ozs.
Iodine (Resublimed).....½ oz.
Water .....16 ozs.

980. With the different solutions all prepared ready for use, the next stage in the operation is to coat the plate with the collodion solution, then immerse it in the silver bath, slowly lowering, without stopping for an instant, until it touches the bottom (otherwise it is apt to show *streaky*). The plate should then be left in the silver bath for three or four minutes. While this is being done the operator usually is tacking up his copy and adjusting the focus on his camera. To get the picture sharp on the ground-glass use the lens wide open; then, placing the cap

on the lens and inserting a small diaphragm, and after removing the ground-glass, the camera will be ready so the plate-holder may be placed in position.

981. **Exposure.**—The amount of time necessary for the exposure must be judged by the amount of reduction, quality of lens and the intensity of light, and this portion of the work can only be learned by practical experience. A safe rule to follow is to expose about ten or fifteen times as long as you would a dry plate under the same conditions. It should be remembered, however, that exposures through the screen for half-tone work will require about four times that of a negative intended for line work.

982. With the exposure determined, and the plate being sufficiently immersed, the operator now returns to the dark-room, lifts his plate from the bath and drains it; then, leaning it against a support, which should be covered with a piece of clean blotting paper, he wipes off the back of the plate with a piece of soft tissue paper. Before placing the plate in the holder, a strip of blotting paper is laid on the trough or bar on which the plate will rest; this will take up silver waste during exposure and prevent rotting of the holder. (If the required exposure is for producing a half-tone plate, care should be taken to see that the half-tone screen has been placed in proper position.)

983. **Making the Exposure.**—The plate-holder is then placed in position on the camera, the slide is withdrawn and the cap removed from the lens for an exposure to obtain the shadows of the copy; then the cap is again placed on the lens and the diaphragm is changed for an exposure to obtain the middle tones, and after the cap is again replaced, a third change is made in the diaphragm and an exposure made for the high-lights. (In making an exposure for coarse screen work, only two diaphragms are used, one for the high-lights and the other for the shadows, as a *contrasty* negative is desirable.) If the exposure is for line work only one diaphragm is used, the size of same depending upon the color of the copy and the amount of reduction.

984. The best results are obtained by changing the

size of stops during the exposure, proportioning the time with each, to give good detail throughout, by making a part of the exposure with the small stop, a part with the next larger stop, and completing with a short exposure with the largest stop. In making negatives for half-tone plates, usually each operator is apt to work differently from another—for instance, some expose first for high-lights, then the middle tones, then the shadows, while others invert the order and expose for the shadows first.

985. Further, in making negatives for half-tones, an important factor is the regulation of the distance between the screen and the negative in the plate-holder—the finer the screen used, the closer it is placed to the plate.

986. **Developing.**—After having made an exposure and replaced the slide in the holder, the latter is removed to the dark-room, which is supplied with a ruby light; then the negative is developed, using the formula already given. In this operation it is necessary to keep the plate moving so the developer will be in motion (the more of the solution that is kept on the plate the denser it will make the negative). When the whole picture is "up," stop the development by washing with a good flow of water under the faucet, and then use the fixing solution and again wash thoroughly, which must be done promptly after each operation.

987. **Intensifying.**—The negative is then intensified by the use of the solution, which has to be determined by the quality of the negative, and after this operation the negative must be "blackened."

988. If, perchance, the negative is found to be too strong both in the high-lights and the shadows, it may be improved by the use of the reducing formula.

989. **Local Treatment.**—The manipulation of the negative in all of these particulars, and also treatment locally—working up small parts to bring necessary gradations of tone—depends entirely upon the skill of the operator.

990. If the negative has been made with the use of a prism, it is necessary that it be dried in an oven and then

coated with a gum arabic solution, made by mixing 2 ounces of gum arabic and 12 ounces of water, or any of the negative varnishes that are on the market. (Note: While practically all engravers use the prism and thereby save the reversing of the films, yet where the prism is not employed and a straight negative has been made, it is necessary to strip it to get it reversed.)

991. After the negative is dry and cool, coat with

**Rubber Solution.**

| | |
|---|---|
| Rubber Cement | 3 ozs. |
| Benzine | 20 ozs. |

992. Then let dry and coat with

**Plain Collodion.**

| | |
|---|---|
| Ether | 8 ozs. |
| Negative Cotton | 120 grs. |
| Alcohol | 8 ozs. |
| Castor Oil | ¼ oz. |

993. Then dry with heat. The castor oil is added to make the film adhere to the glass after being turned. When cool, cut negative to size and shape wanted, then immerse in

**Solution of Acetic Acid.**

1 part Acetic Acid.
8 parts Water.

After laying in acid for about five minutes, negative is ready to strip.

994. In mixing up all formulæ, of course smaller quantities of solution can readily be made by following out the same proportions as stated.

## CHAPTER XXV.

### Ferrotype Process.

995. **Ferrotype Process (Tintype).**—While the making of ferrotypes, commonly called tintypes, is almost a thing of the past, the process is still employed at summer resorts, fairs, and even in many cities. A capable and careful worker may produce results which, while they are not to be compared with the modern processes of photography, are at least superior to the results obtained generally with the process in the hands of an unskilled or careless worker. Lighting, posing and composition can always make themselves felt. The photographer who is painstaking in all departments, in the proper preparing of his collodion silver bath, his developer, and even the cleaning of his ferrotype plates, will produce results that will have commercial value and that will be sought after.

996. The tintype is simply a collodion positive upon a dark enameled plate, called a ferrotype plate. The image appears *reversed as regards left and right.* The process is practically the same as that employed in the making of collodion wet plates, save that metal plates are used in place of glass, and that it is a positive and not a negative. White will appear white on the plate, and black will be black. The coating of the plate, the developing, fixing, intensifying, washing, drying and varnishing are practically the same as with a wet plate negative.

997. **Apparatus and Material—The Camera.**—The apparatus for tintype work usually consists of a 5 x 7 camera, a small three-legged camera stand, and a set of Gem lenses, either four quarter-size tubes or eight one-eighth-size tubes, the former being the most universally used.

998. The camera is fitted with divisions, separating the four pictures on the plate. A special wet-plate holder

is also provided. With this same camera cabinet size pictures can be made, also postal photographs. When used for either of the latter purposes the division is taken out and the Gem lenses are replaced with a portrait lens.

999. For regular studio work, where an outfit for portraits and groups, also tintypes, is desired, then an 8 x 10 portrait camera may be employed with a Gem attachment for making tintypes. Catalogs illustrating these outfits can be secured from any large dealer in photo supplies.

1000. The regular tintype camera has a distinct advantage over the ordinary portrait camera, inasmuch as it is more compact. The plate-holder is supplied with silver wires for the plates to rest upon, and a gutter or glass trough at the bottom to catch the drippings from the plate. If the ordinary plate-holder is used, apply paraffine to the part on which the plate is placed. Blotting paper may also be placed both on the back of the plate and on the bottom of the plate-holder.

1001. **Camera Stands.**—A good, solid stand should be employed, as the exposures necessary will be of considerable length and there should be no danger of the camera jarring.

1002. **Dark-Room.**—Any ordinary dark-room will do. (See description of dark-room in Paragraph 870, instructions on *Wet Plate Process.*)

1003. **Other Materials.**—Bottles for your collodion, same or similar to those used for wet plate process; bottles for developer, and silver bath; glass baths for holding the silver, and one for fixing bath; two dippers—one for silver and one for fixing bath. You should also have one or two glass funnels for filtering.

1004. Ferrotype plates may be purchased by the box or by the dozen. For the beginner a few dozen plates will be sufficient. Purchase the 10 x 14 size and with a shears cut them into four parts; this will give you four 5 x 7 plates. On each 5 x 7 plate you can make four of the ordinary size tintypes. At summer resorts these pictures are often sold as high as four for one dollar. Ordinarily, however, 50 cents is the price for four pictures.

1005. **Making the Collodion.**—Collodion can be purchased ready for use. The Anthony Positive Collodion, which can be purchased from any photographic dealer, will be found exceptionally good and economical. However, for the benefit of those who desire to make their own collodion we give the following formula:

1006.

| | |
|---|---|
| Ether | 20 fl. ozs. |
| Alcohol | 20 fl. ozs. |
| Gun-Cotton | 200 grs. |
| Bromide of Cadmium | 100 grs. |
| Iodide of Cadmium | 80 grs. |
| Iodide of Ammonium | 120 grs. |

Place your gun-cotton in a large-mouthed bottle or graduate; add to this the alcohol and then the ether. When the gun-cotton is entirely dissolved, filter.

1007. **Bromo-Iodize.**—The ether, alcohol and gun-cotton mixture comprises the plain collodion. It must now be bromo-iodized. This is done by simply pouring into a clean graduate a few ounces of the plain collodion and then adding the bromide of cadmium, the iodide of cadmium and the iodide of ammonium. Stir with a glass rod until all ingredients are dissolved, and then add them to the balance of plain collodion.

1008. **Plain Collodion.**—The following formula is also an exceptionally good one:

| | |
|---|---|
| Ether, specific gravity 725 | 10 fl. ozs. |
| Alcohol, specific gravity 805 | 5 fl. ozs. |
| Gun-Cotton | 120 grs. |

Pour your alcohol on the gun-cotton, then your ether, after which filter. This is your *Plain Collodion.*

1009. **Bromo-Iodizer.**—In order to bromo-iodize the plain collodion, dissolve in five fluid ounces of alcohol, the following:

| | |
|---|---|
| Iodide of Cadmium | 50 grs. |
| Bromide of Ammonium | 25 grs. |

When the iodide and bromide are fully dissolved add to the plain collodion.

1010. **Preparing Silver Baths.**—Place 16 ounces of distilled or pure water in your graduate. In this dissolve one grain of potassium iodide, then add one ounce of nitrate of silver. Dissolve the silver and thoroughly mix the solution, allowing it to stand in the sunlight for four or five hours. You will probably find that there will be a slight precipitation. Decant into your silver bath all of the solution that you can without disturbing this precipitation. Next add one or two drops of nitric acid—sufficient to make the bath turn blue litmus paper faintly red. If the silver bath is too acid, marks on the film will appear; if too little acid is used the image will appear flat and of a dirty gray appearance. If the bath is too acid add a little neutral silver solution. Dissolve a little of the neutral silver and add it directly to the bath. To overcome the flat, dirty gray appearance, simply add a drop or two more of nitric acid.

1011. Another very good formula is as follows:

| | |
|---|---|
| Nitrate of Silver, re-crystallized | 5½ ozs. |
| Distilled water | 80 fl. ozs. |
| Nitric Acid C. P | ½ drm. |

1012. This bath should be saturated with iodide of silver and filtered before using. To iodize your bath see Paragraphs 892, 893, *Wet Plate Process.*

1013. **Formula for Developer.—**

| | |
|---|---|
| Water | 16 ozs. |
| Acetic Acid | 1 oz. |
| Protosulphate of Iron | 1 oz. |
| Alcohol | 1 oz. |

1014. As the ingredients used for developer are inexpensive, a large quantity should be prepared in advance. The following amounts will fill a good-sized bottle:

1015. **Preparing the Developer.**—Place 96 ounces of water in a large, clean bottle; then, add 6 ounces of acetic acid (glacial), 6 ounces of protosulphate of iron, and thoroughly dissolve; next, add 6 ounces of alcohol. The alcohol will cause the developer to flow easily.

1016. Another very good formula for developer is as follows:

| | |
|---|---|
| Ferrous-sulphate | 150 grs. |
| Acetic Acid (glacial) | ½ oz. |
| Nitric Acid | 5 minims. |
| Alcohol | ½ oz. |
| Water | 10 ozs. |

**Note.**—By increasing the proportion of nitric acid and decreasing that of acetic acid the image will be more metallic in appearance.

1017. **Collodionizing the Plate.**—On the supposition that you have made all preparations and are ready to make your exposure, you may now proceed to coat or collodionize the plate. Take one of the ferrotype plates and place on the tips of the thumb and fingers of your left hand, sufficiently spreading the fingers to balance the plate. (See instruction, *Wet Plate Process.*) With your right hand take your collodion bottle and pour some of the collodion in the center of the plate (about half the size of the plate), then, very slowly and carefully, slightly tilt the plate in the direction of the upper right-hand corner. Just before the collodion reaches the edge, tilt so that it will run very gently and smoothly toward the upper left-hand corner, then down along the edge toward the lower left-hand corner, and then over to the lower right-hand corner. Pour the excess of collodion into another bottle and allow the plate to drain. Rock gently from edge to edge—not back to front. This will cause the collodion to set evenly and prevent streaks. Just as soon as the plate begins to give a dull surface, the film will have been properly set. Touch the bottom corner, and if no longer tacky or sticky it is ready for immersing in the silver bath. In cold weather collodion will set much slower than in hot weather. It usually requires but a few seconds for the collodion to set.

1018. **Sensitizing.**—The collodion on the ferrotype plate, having been properly set, is now ready for sensitizing. Place the plate on your dipper and slide it with a gentle, continuous motion down into the silver bath. If there is the slighest pause or hesitation it will cause a line across

the plate. It is a good plan to raise and lower the plate a few times after it is immersed. If necessary, carefully wipe out your plate-holder while the plate is sensitizing. In fact, it is a good plan to do so often, as dust is sure to cause all kinds of trouble. The sensitizing of the plate should be done with the door of the dark-room closed, using only the regular dark-room light. You may use considerable of this dark-room light, but it must be yellow or orange. Where the glass bath is enclosed in a box and has a cover, the plate may be dipped into the bath with the dark-room door open, but the cover must be immediately replaced.

1019. After the plate has been in the bath for about a minute or two, raise it from the bath and examine it before the orange light to see that all greasiness has disappeared. In cold weather it will take twice as long to sensitize the plate as it will in warm weather. If you find the waves or oily marks have not disappeared, lower the plate again, but very gently. When the plate appears quite even, dip it a few more times, very slowly. When your plate is properly sensitized, lift it to the top of the bath dish and allow it to drain for a moment. Next, place your plate into the holder. Set it in very gently, and place back of it a piece of glass the exact size of the plate. For example, if you are using 5 x 7 plates, use a 5 x 7 glass. You are then ready to make your exposure.

1020. **Exposing.**—Place your plate-holder in position at the back of the camera, being careful, however, that it is not unnecessarily jarred. Close the shutter and carefully draw the slide, in order to avoid dust. (For exposure, see Paragraph 913, *Wet Plate Process.*) After the exposure has been made, return the slide to the plate-holder in the same manner as you removed it. The length of exposure is governed by the speed of your collodion, strength of light and rapidity of lens used. Usually, from five to ten seconds will be necessary.

1021. **Developing.**—After making the exposure return to your dark-room and proceed to develop the plate. Developing must be done at once, as the plate must be exposed

and developed while it is wet. Close your dark-room door and hold the plate with the glass backing over the sink. The glass backing will hold the tin plate from buckling during development, and the latter is, therefore, much easier handled. Grasp it firmly at the left-hand corner with the thumb and first two fingers of your left hand. Pour the developing solution over the entire plate with a single sweep and gently rock the plate so as to keep the developer flowing to and fro and over the entire surface. This requires a little practice. Never pour on with a splash.

1022. In the sink underneath the plate you should have a bottle with a funnel. In this funnel place a little absorbent cotton. When the developer flows off the plate, it will flow into the funnel. The cotton will filter it and this developer may then be used when developing over-exposures. You should strive to produce as near the correct exposure as possible. This you can only learn by experience and carefully watching your experiments. The exposure cannot be corrected by development, as is the case when developing dry plates. Should you know in advance that the plate is over-exposed, then by applying the once-used developer you will materially improve the results.

1023. **Development of Ferrotype Plate.**—The image will begin to appear almost immediately upon flowing the developer on the plate. When the shadows appear quite clear the plate is fully developed and should be immediately rinsed with water. If the development is stopped too soon the picture will appear too black; if it is allowed to develop too long, the image will appear weak, flat and foggy. When rinsing, do not allow the water to run too strongly on the plate, as it is apt to damage the film. If the ferrotype has been over-developed and, therefore, appears weak and flat, you can improve it by adding a drop or two of iodine to the fixing bath. In order that your entire fixing bath does not become charged with iodine, pour a little of the regular fixing bath into the tumbler or graduate and add the iodine to this. Pour a sufficient quantity of this fixing bath over

the ferrotype plate, in exactly the same manner as you did the developer, draining the surplus solution back into the tumbler to save for future use. With the image on the plate brought to its proper stage, rinse under the tap and place into the regular fixing bath.

1024. **Fixing.**—After the image is fixed it must be carefully washed. While this can be done in a very few minutes you must be careful that it is done thoroughly. If the cyanide is not washed out of the film the finished picture will in a very short time turn yellow and entirely disappear. Therefore, be careful that the plate receives a thorough washing. See *formula for fixing bath, Par. 898.*

1025. **Drying.**—When the plate is washed it may be placed in a negative rack and allowed to dry. As a general rule, however, the picture is to be finished as quickly as possible; therefore, the plate should be dried over a gas or oil stove, or a lamp. You may heat this plate as hot as your hands will bear. While drying, continually move the plate over the heat so that the plate will be heated and dried evenly. When the plate is thoroughly dry it is ready for varnishing.

1026. **Varnishing.**—When dry, the image on the ferrotype plate is extremely soft and tender, and if your fingers or anything else were to come in contact with it, it would scratch or mar it. It is necessary, therefore, that it receive a hard coating, which will protect it, and for this purpose a transparent varnish is generally employed. You can purchase this already made, or, if you desire, you can prepare it yourself according to the following formula:

1027. **Gasoline Varnish for Tintypes.**—Place one gallon of gasoline in an ordinary oil can, and add one pound of powdered resin. Then place the can containing the gasoline and resin into a kettle of boiling water. To create a vent, loosen or remove the top of the can. Unless this is done there is danger of explosion. When the water becomes cool discard it and add more boiling water. Continue this until the resin is entirely dissolved.

1028. **Caution.**—Under no condition prepare this var-

nish near a stove or where there is fire, gas or lamp light, as the fumes of gasoline are extremely explosive. If the varnish is not heavy enough, or does not supply enough gloss, add more resin.

1029. **Drying—After Varnishing.**—Flow this varnish over your tin plate in the same manner that you would any other varnish. Then hold over a flame, allowing the varnish on the plate to catch fire. After it has burned for a second, blow it out and then dry over a gentle heat. The varnish, when dry, supplies an extremely hard surface with an exceptionally brilliant gloss.

1030. When other than the gasoline varnish is used, the varnish should be flowed over the plate in exactly the same manner as you did the collodion; and, then held over the heat to dry until the varnish is hard and perfectly set. If you have used four lens tubes and, therefore, made four exposures on the plate, they must then be cut apart to fit your ferrotype or tintype holder. Cut the proper size and trim off the corners. By trimming off the corners you can slide them into the folders more readily. They are then ready for delivery.

## CHAPTER XXVI.

# HOW THE STUDIES ILLUSTRATING THIS VOLUME WERE MADE.

**Study No. 2,** title, "Woodland Mist," by W. T. Knox, New York, N. Y. The weather conditions, dull and misty; exposure was made in the morning; lens used, single combination of Zeiss; focal length, 23 inches; stop used, No. 4; exposure given, 4 seconds; plate used, Cramer Instantaneous Isochromatic; developer, pyro. Diffusion was obtained in focusing on the foreground. Printing process, platinum; mounted on a dark grey mount.

**Study No. 3,** title, "Morning Lights and Shadows," by J. H. Field, Berlin, Wis. Weather conditions, sun shining through the mist; time of day exposure was made, about 6 A. M.; lens used, Rapid Rectilinear, using rear half of lens only; focal length, 15 inches; stop used, wide open; exposure given, 1 second; plate used, Cramer Medium Isochromatic; developer, pyro-acetone. The diffused focus in this picture was obtained by printing through celluloid and thin paper. The negative was slightly reduced in the sky portions after development. Printing process, Willis & Clements Platinum, black and white. This print was made from an enlarged negative, the original size of which was 5 x 7; mount was on oil tissue paper over cream.

**Study No. 4,** title, "At Peace (War ship)," by Dr. A. R. Benedict, Montclair, N. J. The weather was cloudy, with a clear atmosphere; exposure was made at 4:30 P. M.;

lens used, Rapid Rectilinear; focal length, 6½ inches; stop used, U. S. 4; exposure given, $\frac{1}{25}$ second. Negative was made on an Eastman film; developed with metol-hydroquinone, with no after manipulation of the negative; printing process, the direct print from the negative on velox, redeveloped with Eastman sepia redeveloper. Note: This picture was made from two negatives; that is, the clouds were printed in. Both negatives, however, were taken on the same day, the clouds in one negative and the scene in the other, and then printed in. This scene is on the Hudson river.

**Study No. 5,** title, "Sheep," by W. E. Bertling, Buffalo, N. Y. Mr. Bertling states: "I use in all my work a Goerz lens, focal length 7 inches, and generally use diaphragms full opening, Forbes dry plates and develop with Pyrocatechin. I obtain my diffused focus by using full opening of lens and focusing upon middle distance. Printing process, usually developing paper of various kinds. In making my picture I always endeavor to get an element of sky effect in my landscapes, and always give plenty of time in exposure up to a reasonable limit. I always start development with weak developer and strengthen afterwards to suit requirements. For personal use and exhibition purposes generally I use the carbon process or glycerine platinum process. I generally try to work out the salvation of my subject in the printing process. The various kinds of pigment processes offer a wide field for manipulation, and this advantage possesses an attraction for me."

**Study No. 7,** title, "Snow Lights," by Geo. H. Scheer, M. D., Sheboygan, Wis. Hung at the Fourth American Salon. This picture was made on a very bright sunny day, at about 3 P. M., in the month of March. Lens used, Rapid Rectilinear, wide open; plate used, Orthonon; exposure given, one second, with Burke & James Ideal Ray Filter; developed in dilute pyro-soda developer. Print was made by straight enlargement from an unaltered negative; enlargement was made on Platinoid Bromide, 10 x 12 inches, from only a portion of a 5 x 7 negative.

**Study No. 8,** title, "A Dull October Day," by John Chis-

lett, Indianapolis, Ind. Exposure was made at 4:30 P. M., with a Smith lens, very slightly stopped down; plate used, Cramer Instantaneous Isochromatic; exposure given, 2 seconds; plate was developed in ortol; there was no altering of the negative or manipulation after development; print was made on Platinum paper, with the foreground darkened in the printing, and a sky printed in from a separate negative. The print was mounted on a light Scotch grey mount.

**Study No. 9,** title, "Wave Action," by J. R. Peterson, Portland, Ore. Picture was accepted and hung at Third American Salon. This picture was taken after a clearing storm, with a dull light; exposure was made at 10 A. M. in the month of May; lens used was the rear combination of the Plastigmat; focal length, 18 inches; stop used, wide open; exposure given was $\frac{1}{25}$ second; plate used, 5 x 7 Orthonon; developer, rodinal. The diffused focus was obtained by focusing for foreground; the printing process was carbon. This negative was worked on by making positives and negatives to increase contrast and to print in the sky, and afterwards the picture was enlarged to 8 x 10. Picture was mounted on black mount.

**Study No. 11,** title, "Sand Dune," by J. S. Neary, Trenton, N. J. This picture was taken about 5 o'clock, with a Goerz lens fitted to a $6\frac{1}{2}$ x $8\frac{1}{2}$ camera; plate used was double coated, developed in ortol, and with no after manipulation.

**Study No. 12,** title, "The Uphill Road," by Geo. H. Scheer, M. D., Sheboygan, Wis. This picture was made on a very bright sunny day, with good clouds in the sky, at about 3 P. M., in the month of July. The lens used was Rapid Rectilinear, worked wide open; plate used was Orthonon; exposure given, $\frac{1}{2}$ second, with a Burke & James Ray Filter. Plate was developed by tank development in 25-minute-pyro formula. The negative was enlarged from an altered negative. Enlargement was made on Platinoid Bromide, the sky portion receiving somewhat longer exposure than the rest of the picture.

**Study No. 13,** title, "A Tokio Waterway," in Tokio, Japan, by William H. Phillips, Liverpool, Ohio. Camera

used was a No. 3 Folding Pocket Kodak; lens used, Goerz 5 inch focus, Series 3; negative was made on non-curling film, developed in Pyro Soda developer. Print is an enlargement on Royal Bromide, size 11 x 16 inches, developed with rodinol strong solution—one part rodinol, six parts water.

**Study No. 14,** title, "Ocean Waves," by J. S. Neary, Trenton, N. J. Exposure was made about 6 A. M.; lens used was Goerz, fitted to a 6½ x 8½ Century camera; plate used, double coated; developed with ortol, with no after manipulation. Print was mounted on carbon black cardboard.

# APPENDIX.

## "American Annual" Table of Symbols, Atomic Weight and Solubilities of the Principal Chemicals used in Photography.

*Abbreviations.*—s., soluble; v. s., very soluble; sp. s., sparingly soluble; n. s., not soluble; dec., decomposed; del., deliquescent.

| Name. | Symbol. | Molecular Weight. | One Part is Soluble in Cold Water | One Part is Soluble in Hot Water | Alcohol. |
|---|---|---|---|---|---|
| Acid, Acetic | $C_2H_4O_2$ | 60 | in any proportion. | | |
| " Boric or Boracic | $H_3BO_3$ | 62 | 25 | 3 | 6 |
| " Carbolic (see Phenol) | $C_6H_6O$ | 94 | 16.6 | 3 | 6 |
| " Citric | $C_6H_8O_7+H_2O$ | 210 | 0.75 | 0.5 | s. |
| " Digallic (see Tannin) | $C_{14}H_{10}O_9$ | 322 | 0.8 | 0.5 | 0.8 |
| " Gallic | $C_7H_6O_5$ | 170 | 100 | 3 | 8 |
| " Hydrobromic | HBr | 81 | s. | s. | s. |
| " Hydroiodic | HI | 128 | s. | s. | s. |
| " Hydrochloric | HCl | 36.5 | s. | s. | s. |
| " Hydrofluoric | HFl | 20 | s. | s. | s. |
| " Hydrocyanic | HCy or CN | 27 | s. | s. | s. |
| " Hydro-sulphuric | $H_2S$ | 34 | s. | s. | s. |
| " Muriatic (see Hydrochloric) | ..... | ..... | ..... | ..... | ..... |
| " Nitric | $HNO_3$ | 63 | in all proportions. | | |
| " Nitrous | $HNO_2$ | 47 | absorbed. | | ..... |
| " Oxalic | $C_2H_2O_4+2H_2O$ | 126 | 8 | 0.2 | s. also in ether |
| " Pyrogallic (see Pyrogallol) | $C_6H_6O_3$ | 126 | 2 | v. s. | also v. s. in ether. |
| " Salicylic | $C_7H_6O_3$ | 138 | 7.6 | 9 | also v. s. in ether. |

| | | | | | |
|---|---|---|---|---|---|
| Acid, Sulphuric | $H_2SO_4$ | 98 | in any proportion. | | |
| " Sulphurous | $H_2SO_3$ | 82 | absorbed. | | |
| " Tannic (see Digallic) | | | | | |
| " Tartaric | $C_4H_6O_6$ | 150 | 0.8 | 0.5 | 5 |
| Alcohol, Ethyl | $C_2H_6O$ | 46 | in all proportions. | | |
| Alcohol, Methyl (see Wood Alcohol) | $CH_4O$ | 32 | in all proportions. | | |
| Alum (see Potassium Aluminium Sulphate) | $Al_2(SO_4)_3K_2SO_4+24H_2O$ | 948.8 | 10 | 8 | n. s. |
| Alum Chrome (see Potassium Chromic Sulph.) | $Cr_2(SO_4)_3K_2SO_4+24H_2O$ | 998.4 | 10 | dec. | n. s. |
| Amidol (Diamido Phenol) | $C_6H_8N_2O$ | 124 | very soluble. | | |
| Ammonia, Gaseous | $NH_3$ | 17 | very soluble. | | |
| Ammonium Bichromate | $(NH_4)_2Cr_2O_7$ | 252 | v. s. | v. s. | |
| " Bromide | $NH_4Br$ | 98 | 1.29 | 0.7 | 31.5 |
| " Cadmium Bromide | $2NH_4Br2CdBr_2+H_2O$ | 678 | 0.73 | | 5.3 |
| " " Iodide | $2NH_4ICdI_2+2H_2O$ | 545 | 0.58 | | 0.7 |
| " Chloride | $NH_4Cl$ | 53.5 | 3 | 1 | sp. s. |
| " Ferric Oxalate | $Fe_2(C_2O_4)_6(NH_4)_6+8H_2O$ | 892 | 2.1 | 0.29 | sp. s. |
| " Fluoride | $NH_4Fl$ | 37 | v. s. | v. s. | sp. s. |
| " Iodide | $NH_4I$ | 145 | 1 | 0.5 | s. |
| " Nitrate | $NH_4NO_3$ | 80 | 2 | 1 | s. |
| " Oxalate | $(NH_4)_2C_2O_4$ | 124 | 4 | 2 | s. |
| " Persulphate | $(NH_4)SO_4$ | | | | |
| " Sulpho-Cyanate | $NH_4CNS$ | 76 | s. | s. | s. |
| Aurantia (Hexanitro-diphenylamin Ammonia) | $NH_4C_{12}H_4(NO_2)_6N$ | 456 | | | |
| Aurin (Trioxy-triphenyl Carbinol) | $C_{19}H_{14}O_3$ | 290 | | | |
| Barium Chloride | $BaCl_2+2H_2O$ | 244 | 2.18 | 1.5 | sp. s. |
| " Nitrate | $Ba(NO_3)_2$ | 261 | 12.2 | 2.84 | n. s. |
| " Per-oxide | $BaO_2$ | 169 | v. s. | n. s. | n. s. |
| Benzole or Benzine (Trioxy-tryphenyl-Carbinol) | $C_6H_6$ | 78 | n. s. | n. s. | s. |
| Borax (see Sodium Biborate) | | | | | |
| Cadmium Bromide | $CdBr_2+4H_2O$ | 344 | 1.5 | 1 | sp. s. |
| " Iodide | $CdI_2$ | 366 | 1.5 | 1 | s. |
| Calcium Bromide | $CaBr_2$ | 200 | 1 | .75 | s. |
| " Carbonate (see Chalk) | $CaCO_3$ | 100 | n. s. | n. s. | n. s. |
| " Chloride | $CaCl_2+6H_2O$ | 219 | .75 | 5 | 10 |

## TABLE OF SYMBOLS, ATOMIC WEIGHT AND SOLUBILITIES OF THE PRINCIPAL CHEMICALS USED IN PHOTOGRAPHY.

*Abbreviations.*—s., soluble; v. s., very soluble; sp. s., sparingly soluble; n. s., not soluble; dec., decomposed; del., deliquescent.

| Name. | Symbol. | Molecular Weight. | One Part is Soluble in Cold Water | One Part is Soluble in Hot Water | Alcohol. |
|---|---|---|---|---|---|
| Calcium Hypochlorite (see Chloride of Lime) | $CaCl_2O_2CaCl_2$(?) | 254 | sp. s. | sp. s. | dec. |
| Calomel (see Mercurous Chloride) | ..... | ..... | ..... | ..... | ..... |
| Camphor | $C_{10}H_{16}O$ | 152 | 1000 | ..... | v. s. |
| Caustic Potash (see Potassium Hydrate) | ..... | ..... | ..... | ..... | ..... |
| " Soda (see Sodium Hydrate) | ..... | ..... | ..... | ..... | ..... |
| Chalk (see Calcium Carbonate) | ..... | ..... | ..... | ..... | ..... |
| Chinoline Blue or Cyanine | $C_{29}H_{35}NaI$ | 533 | sp. s. | sp. s. | s. |
| " Red | $C_{26}H_{19}NaCl$ | 389.5 | ..... | ..... | ..... |
| Chloride of Lime (see Calcium Hypochlorite) | ..... | ..... | ..... | ..... | ..... |
| Chlorine | Cl | 35.5 | absorbed by 1 to 2.5 vols. | ..... | ..... |
| Chloroform | $CHCl_3$ | 119.5 | sp. s. | sp. s. | v. s. |
| Chrome-Alum (see Alum Chrome) | ..... | ..... | ..... | ..... | ..... |
| Copper Acetate (see Verdigris) | $Cu(C_3H_3O_2)_2+H_2O$ | 223.4 | 14 | 5 | 1 in 14 |
| " Bromide | $CuBr_2$ | 223.4 | 1 | .75 | s. |
| " Chloride | $CuCl_2+H_2O$ | 152.4 | 1 | .75 | v. s. |
| " Sulphate (see Blue Vitriol) | $CuSO_4+5H_2O$ | 249.4 | 3 | 1 | n. s. |
| " " and Ammonia | $CuSO_4+4NH_3+H_2O$ | 245.4 | s. | v. s. | n. s. |
| Corrosive Sublimate (see Mercuric Chloride) | ..... | ..... | ..... | ..... | ..... |
| Dextrine | $C_6H_{10}O_5$ | 162 | easily s. | | n. s. |
| Eikonogen (Amido-$\beta$-Naphthol-$\beta$-Monosulphonate of Sodium) | $C_{10}H_8SO_4NaN$ | 261 | 40 | e. s. | s. |
| Eosine, Yellow Shade (Tetra Bromo-fluoresceine Potassium) | $C_{20}H_6Br_4O_5K_2$ | 724 | s. | s. | s. |

| | | | | | |
|---|---|---|---|---|---|
| Eosine, Red Shade (Tetra Brom.-fluores. Sod.) | $C_{20}H_6Br_4O_5Na_2$ | 692 | s. | s. | s. |
| Epsom Salt (see Magnesium Sulphate) | | | | | |
| Erythrosine M. (Tetra Iodo-fluoresceine Potassium or Sodium) | $C_{20}H_6I_4O_5K_2$ or $Na_2$ | 912 or 880 | s. | s. | s. |
| Erythrosine G. (Di-iodo-fluoresceine Potassium or Sodium) | $C_{20}H_6I_2O_5K_2$ or $Na_2$ | 658 or 626 | s. | s. | s. |
| Gelatine, Glutine | Unobtainable | | sp. s. | e. s. | n. s. |
| Glycerine | $C_3H_8O_3$ | 92 | in all proportions. | | |
| Glycine (Oxy-phenylglycine) | $C_8H_9O_3N$ | 162 | | | |
| Gold, Neutral Chloride | $AuCl_3$ | 302.5 | 1 | 5 | also in ether. |
| " and Cadmium Chloride | $AuCl_5Cd$ | 485.5 | s. | s. | s. |
| " and Potassium Chloride | $AuCl_4K+5H_2O$ | 467 | s. | s. | s. |
| " and Sodium Chloride | $AuCl_4Na+2H_2O$ | 397 | s. | s. | s. |
| " Sodium Hypo-sulphite | $AuNa_3S_4O_6+2H_2O$ | 525 | s. | s. | s. |
| Gun Cotton (Tetra-nitrate Cellulose) | $C_{12}H_{16}O_6(NO_3)_4$ | 504 | n. s. | n. s. | in ether |
| " " (Tri-nitrate Cellulose) | $C_{10}H_{17}O_7(NO_6)_3$ | 579 | n. s. | n. s. | alcohol |
| Hydroquinone | $C_6H_6O_2$ | 110 | s. | s. | also in ether. |
| Hydroxylamine Hydrochlorate | $NH_3OHCl$ | 69.5 | 0.6 | e. s. | 4 |
| Iodine | I | 127 | sp. s. | sp. s. | e. s. |
| Iridium Tetra Chloride | $IrCl_4$ | 335 | | | |
| Iron, Ammonium Sulphate | $FeSO_4(NH_4)_2SO_4+6H_2O$ | 392 | v. s. | dec. | n. s. |
| " Chloride (Ferric) | $Fe_2Cl_6$ | 325 | .75 | .5 | 1 in 1 |
| " Chloride (Ferrous) | $Fe_2Cl_2$ | 127 | 2 | 1 | 1 in 1 |
| " Citrate | $Fe_2(C_6H_5O_7)_2$ | 490 | s. | s. | n. s. |
| " Citrate and Ammonium | $Fe_2(C_6H_5O_7)_2+(NH_4)_3$ | 544 | s. | s. | sp. s. |
| " Iodide | $FeI_2+4H_2O$ | 382 | v. s. | v. s. | v. s. |
| " Nitrate | $Fe(NO_3)_2+6H_2O$ | 28[illegible] | v. s. | dec. | dec. |
| " Oxalate (Ferric) | $Fe_2(C_2O_4)_3$ | 376 | s. | s. | n. s. |
| " " (Ferrous) | $FeC_2O_4$ | 144 | in potas sium oxal. | | n. s. |
| " Sulphate (Ferric) | $Fe_2(SO_4)_3+9H_2O$ | 566 | s. | dec. | s. |
| " " (Ferrous) | $FeSO_4+7H_2O$ | 278 | 1.5 | 1 | n. s. |
| Kaoline | $Al_2Si_2O_7+2H_2O$ | 258.8 | not soluble. | | |
| Lead, Acetate (see Sugar of Lead) | $Pb(C_2H_3O_2)_2$ | 325 | 2.5 | 2 | 1 in 12.5 |
| " Carbonate | $PbCO_3$ | 267 | n. s. | sp. s. | n. s. |
| " Iodide | $PbI_2$ | 461 | s. | s. | n. s. |

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*Abbreviations.*—s., soluble; v. s., very soluble; sp. s., sparingly soluble; n. s., not soluble; dec., decomposed; del., deliquescent.

| Name. | Symbol. | Molecular Weight. | One Part is Soluble in Cold Water | One Part is Soluble in Hot Water | Alcohol. |
|---|---|---|---|---|---|
| Lead, Nitrate | $Pb(NO_3)_2$ | 331 | 7.7 | 7 | s. |
| " Oxide | PbO | 223 | n. s. | n. s. | Alkalis. |
| Lithium, Bromide | LiBr | 87 | .66 | .5 | v. s. |
| " Chloride | $LiCl+H_2O$ | 60.5 | 1.3 | 1 | s. |
| " Iodide | $LiI+3H_2O$ | 188 | .61 | .5 | s. |
| Magnesium, Bromide | $MgBr_2$ | 184.4 | 1 | .75 | s. |
| Magnesium, Chloride | $MgCl_2$ | 95.4 | 2 | 1.5 | s. |
| " Iodide | $MgI_2$ | 278.4 | 1 | .75 | v. s. |
| " Sulphate (see Epsom Salt) | $MgSO_4,7H_2O$ | 246.4 | 1.3 | 1 | sp. s. |
| Manganous Chloride | $MnCl_2+4H_2O$ | 198 | s. | s. | n. s. |
| Mercury, Chloride (Mercuric) (see Corr. Subl.) | $HgCl_2$ | 271 | 19 | 3 | 5 |
| " " (Mercurous) (see Calomel) | $Hg_2Cl_2$ | 471 | n. s. | n. s. | n. s. |
| " Cyandie | $HgCy_2$ or $(CN)_2$ | 252 | 8 | 2 | 1 in 20 |
| " Iodide (Mercuric) | $HgI_2$ | 454 | sp. s. | sp. s. | sp. s. |
| " " (Mercurous) | $Hg_2I_2$ | 654 | n. s. | n. s. | n. s. |
| Metol (Mono-methyl Para-amidometakresol) | $C_8H_{11}NO$ | 137 | s. | s. | s. |
| Para-amidophenol | $C_6H_7NO$ | 109 | sp. s. | s. | ..... |
| Para-amidophenol Sodium | $C_6H_6NaNO$ | 131 | easily soluble. | | ..... |
| Para-amidophenol Hydrochlorate | $C_6H_7NOHCl$ | 145.5 | s. | s. | s. |
| Para-rosaniline (Triamido-phenyl-Carbinol). | $C_{19}H_{19}N_3O$ | 305 | ..... | ..... | ..... |
| Phenol (see Carbolic Acid) | ..... | ..... | ..... | ..... | ..... |
| Platino-potassium Chloride or Chloro-platinite | $K_2PtCl_4$ | 417.4 | 6 | ..... | s. |

| | | | | | |
|---|---|---|---|---|---|
| Platino-sodium Chloride or Chloro-platinite of Sodium | $Na_2PtCl_4$ | 385.4 | soluble. | | |
| Platinum Chloride | $PtCl_4+5H_2O$ | 429.4 | | * | |
| Potassa (see Potassium Hydrate) | | | | | |
| Potassium, Aluminium Sulphate (see Alum) | | | | | |
| " Bicarbonate | $KHCO_3$ | 100 | 3 | 2 | n. s. |
| " Bichromate | $K_2Cr_2O_7$ | 294.4 | 10 | 7 | n. s. |
| " Bromide | KBr | 119 | 2 | 1 | 1 in 90 |
| " Carbonate | $K_2CO_3$ | 138 | .75 | .5 | n. s. |
| " Chlorate | $KClO_3$ | 122.5 | 16 | 2 | n. s. |
| " Chloride | KCl | 74.5 | 3 | 2 | sp. s. |
| " Chromic Sulph. (see Chrome-Alum) | | | | | |
| " Citrate | $K_3C_6H_7O_8$ | 324 | 6.6 | .3 | n. s. |
| " Cyanide | KCy or (CN) | 65 | 1 | .5 | sp. s. |
| " Ferric Sulphate | $K_2SO_4+Fe_2(SO_4)_3+24H_2O$ | 957 | s. | s. | n. s. |
| " Ferri-cyanide (see Red Prussiate) | $K_3FeCy_6$ | 329.3 | 2.5 | 1.2 | n. s. |
| " Ferro-cyanide (see Yellow Pruss.) | $K_4FeCy_6+3H_2O$ | 422 | 3 | 1 | n. s. |
| " Fluoride | KFl | 58 | v. s. | v. s. | v. s. |
| " Hydrate | KOH | 56 | .5 | .25 | sp. s. |
| " Iodide | KI | 166 | .75 | .5 | 1 in 16 |
| " Nitrate (see Saltpetre) | $KNO_3$ | 101 | 4 | 1 | n. s. |
| " Oxalate | $K_2C_2O_4+2H_2O$ | 202 | 3 | 2 | sp. s. |
| " Permanganate | $KMnO_4$ | 158 | 16 | 10 | n. s. |
| " Sulpho-cyanate | KCyS | 97 | 2 | 1 | sp. s. |
| Pyrogallol (see Pyrogallic Acid) | | | | | |
| Rhodan (German appellation for Cyanates) | | | | | |
| Rodinal (ready-prepared Para-amido Devel.) | | | | | |
| Silver, Acetate | $AgC_2H_3O_2$ | 167 | sp. s. | sp. s. | n. s. |
| " Bromide | AgBr | 188 | n. s. | n. s. | in HCl and HBr. |
| " Carbonate | $Ag_2CO_3$ | 276 | n. s. | n. s. | n. s. |

* Real platiuum-chloride is but little soluble in water; the article of commerce of that name answers to the formula $PtCl_4 2HCl+6H_2O$, and is of the atomic weight 520.4 (K. Schwier). It is easily soluble in water, probably in the proportion of 1.6.

## TABLE OF SYMBOLS, ATOMIC WEIGHT AND SOLUBILITIES OF THE PRINCIPAL CHEMICALS USED IN PHOTOGRAPHY.

*Abbreviations.*—s., soluble; v. s., very soluble; sp. s., sparingly soluble; n. s., not soluble; dec., decomposed; del., deliquescent.

| Name. | Symbol. | Molecular Weight. | One Part is Soluble in Cold Water | One Part is Soluble in Hot Water | Alcohol. |
|---|---|---|---|---|---|
| Silver, Chloride | $AgCl$ | 143.5 | n. s. | n. s. | Ammonia. cyan. potass. hypo-sulphite of soda. |
| " Citrate | $Ag_3C_6H_5O_7$ | 513 | sp. s. | sp. s. | ..... |
| " Fluoride | $AgFl$ | 127 | v. s. | v. s. | v. s. |
| " Iodide | $AgI$ | 235 | n. s. | n. s. | same as Chloride. |
| " Nitrate | $AgNO_3$ | 170 | 1 | .5 | sp. s. |
| " Nitrite | $AgNO_2$ | 154 | 300 | dec. | n. s. |
| " Oxalate | $Ag_2C_2O_4$ | 302 | sp. s. | s. | n. s. |
| " Oxide | $Ag_2O$ | 232 | n. s. | n. s. | n. s. |
| " Sulphide | $Ag_2S$ | 248 | n. s. | n. s. | n. s. |
| Soda, Caustic (see Sodium Hydrate) | ..... | ..... | ..... | ..... | ..... |
| Sodium Acetate | $NaC_2H_3O_2+3H_2O$ | 136 | 3 | .66 | n. s. |
| " Biborate (Borax) | $Na_2B_4O_7+10H_2O$ | 382 | 12.5 | 2 | n. s. |
| " Bromide | $NaBr$ | 103 | 1.25 | 1 | 1.16 |
| " Bicarbonate | $NaHCO_3$ | 84 | 12 | dec. | n. s. |
| " Carbonate | $Na_2CO_3+10H_2O$ | 286 | 2 | 1 | n. s. |
| " Chloride | $NaCl$ | 58.5 | 2.75 | 2.75 | n. s. |
| " Citrate | $Na_3C_6H_5O_7$ | 258 | 1 | .5 | sp. s. |
| " Hydrate | $NaHO$ | 40 | 1.5 | .5 | sp. s. |
| " Hypo-sulphite | $Na_2S_2O_3+5H_2O$ | 248 | 1.5 | 1 | sp. s. |
| " Iodide | $NaI$ | 150 | .5 | .3 | sp. s. |
| " Nitrate | $NaNO_3$ | 85 | 1.36 | 1 | 1 in 37 |

| | | | | | |
|---|---|---|---|---|---|
| Sodium Sulph-antimoniate or Schlippe's Salt | $Na_3SbS_4$ | 317 | s. | s. | n. s. |
| " Sulphate | $Na_2SO_4+10H_2O$ | 322 | 2 | 4 | s. |
| " Sulphide | $Na_2S+9H_2O$ | 240 | s. | s. | sp. s. |
| " Sulphite | $Na_2SO_3+7H_2O$ | 252 | 4 | 2 | sp. s. |
| " Tungstate | $Na_2WO_4+2H_2O$ | 330 | s. | s. | n. s. |
| " Thio-sulphate (see Hypo-sulphite) | | | | | |
| Strontium, Bromide | $SrBr_2+6H_2O$ | 355.5 | 1 | .75 | sp. s. |
| " Chloride | $SrCl_2+6H_2O$ | 266.5 | 1.8 | 1 | sp. s. |
| Strontium, Nitrate | $Sr(NO_3)_2$ | 211.5 | 5 | 2 | sp. s. |
| Sugar of Lead (see Lead Acetate) | | | | | |
| Tannin (see Digallic Acid) | | | | | |
| Thymol | $C_6H_3CH_3(C_3H_7)COO$ | 177 | sp. | | and in ether. |
| Tin, Chloride (Stannic) | $SnCl_4$ | 260 | dec. | in much | water. |
| " Chloride (Stannous) | $SNCl_2+2H_2O$ | 225 | 135:100 | 655:100 | v. s. |
| Uranium, Bromide | $UBr_2+4H_2O$ | 472 | 1 | .5 | sp. s. |
| " Nitrate | $UO_2(NO_3)_2+6H_2O$ | 504 | .5 | .25 | v. s. |
| " Sulphate | $UO_2SO_4+3H_2O$ | 422 | .5 | .25 | v. s. |
| Verdigris (see Copper Acetate) | | | | | |
| Vitriol, Blue (see Copper Sulphate) | | | | | |
| " Green (see Iron Sulphate) | | | | | |
| " White (see Zinc Sulphate) | | | | | |
| Water | $H_2O$ | 18 | | | |
| Washing Soda (see Sodium Carbonate) | | | | | |
| Wood Alcohol (see Alcohol Methyl) | | | | | |
| Zinc, Bromide | $ZnBr_2$ | 225 | del. | and e. s. | s. |
| " Chloride | $ZnCl_2$ | 136 | .33 | | s. |
| " Iodide | $ZnI_2$ | 319 | .33 | dec. | v. s. |
| " Nitrate | $Zn(NO_3)_2+6H_2O$ | 297 | del. | del. | del. |
| " Sulphate (see White Vitriol) | $ZnSO_4+7H_2O$ | 287 | 2 | 1 | n. s. |
| Zircon Earth | $ZrO_2$ | 122 | n. s. | n. s. | n. s. |

## TABLES OF THE SYMBOLS, CLASSES OR GROUPS.

### Atomic and Equivalent Weights of the Elements.

| NAME. | SYMBOL. | GROUP. | ATOMIC WEIGHT. | EQUIVALENT WEIGHT. |
|---|---|---|---|---|
| Aluminum | Al | III (IV) | 27.4 | 13.7 |
| Antimony (Stibium) | Sb | III (V) | 120.0 | 120.0 |
| Arsen | As | III (V) | 75.0 | 75.0 |
| Barium | Ba | II | 137.0 | 68.5 |
| Berryllium (Glucinum) | Be | II or III | 9.4 | 4.7 |
| Bismuth | Bi | III (V) | 208.0 | 208.0 |
| Boron | B | III (V) | 11.0 | 11.0 |
| Bromine | Br | I (III, V, VII) | 80.0 | 80.0 |
| Carbon | C | IV | 12.0 | 6.0 |
| Cadmium | Cd | II | 112.0 | 56.0 |
| Caesium | Cs | I | 133.0 | 133.0 |
| Calcium | Ca | II | 40.0 | 20.0 |
| Cerium | Ce | III (IV) | 140.0 | 46.0 |
| Chlorine | Cl | I (III, V, VII) | 35.5 | 35.5 |
| Chromium | Cr | IV (VI) | 52.2 | 26.1 |
| Cobalt | Co | II (IV) | 58.8 | 29.4 |
| Copper | Cu | II | 63.4 | 31.7 |
| Didymium | Di | III | 145.0 | |
| Erbium | E | III | 166.0 | |
| Fluorine | F | I | 19.0 | 19.0 |
| Gallium | Ga | IV | 69.0 | |
| Germanium | Ge | IV | 72.2 | |
| Glucinum | G | II | 9.4 | 9.4 |
| Gold | Au | I (III) | 196.0 | 196.0 |
| Hydrogen | H | I | 1.00 | 1.00 |
| Indium | In | III (IV?) | 113.4 | 37.8 |
| Iodine | I | I, III, V, VII | 127.0 | 127.0 |
| Iridium | Ir | II (IV, VI) | 193.0 | 99.0 |
| Iron | Fe | II (IV, VI) | 56.0 | 28.0 |
| Lanthanium | La | III | 138.5 | 46.3 |
| Lead (Plumbum) | Pb | II (IV) | 207.0 | 103.5 |
| Lithium | Li | I | 7.0 | 7.0 |
| Magnesium | Mg | II | 24.4 | 12.2 |
| Manganese | Mn | II (IV, VI, VII) | 55.0 | 27.5 |
| Mercury | Hg | II | 200.0 | 100.0 |
| Molybdenum | Mo | VI | 96.0 | 46.0 |

**Table of the Symbols, Etc.**— *Continued.*

| Name. | Symbol. | Group. | Atomic Weight. | Equivalent Weight. |
|---|---|---|---|---|
| Niobium (Columbium) | Nb | V | 94.0 | 18.8 |
| Nickel | Ni | II (IV) | 58.8 | 29.4 |
| Nitrogen | N | III (V) | 14.0 | 14.0 |
| Osmium | Os | II (IV, VI, VII) | 199.0 | 99.5 |
| Oxygen | O | II (IV?) | 16.0 | 8.0 |
| Palladium | Pd | (II, IV, VI) | 106.0 | 53.25 |
| Phosphorus | P | III (V) | 31.0 | 31.0 |
| Platinum | Pt | II (IV, VI) | 196.0 | 98.7 |
| Potassium (Kalium) | K | I | 39.0 | 39.0 |
| Rhodium | Rh | II (VI) | 103.5 | 52.2 |
| Rubidium | Rb | I (V) | 85.4 | 85.4 |
| Ruthenium | Ru | II(IV, VI, VIII) | 101.4 | 52.2 |
| Scandium | Sc | II (IV, VI, VII) | 43.9 | 52.2 |
| Selenium | Se | II (IV, VI) | 79.0 | 39.7 |
| Silicon (Silicium) | Si | IV | 28.0 | 14.0 |
| Silver (Argentum) | Ag | I | 108.0 | 108.0 |
| Sodium (Natrium) | Na | I | 23.0 | 23.0 |
| Strontium | Sr | II | 87.5 | 43.7 |
| Sulphur | S | II (IV, VI) | 32.0 | 16.0 |
| Tantalum | Ta | V | 182.0 | 36.4 |
| Tellurium | Te | II (IV, VI) | 127.0 | 64.0 |
| Thallium | Tl | I (III) | 204.0 | 204.0 |
| Thorium | Th | IV | 232.5 | 57.87 |
| Tin (Stannum) | Sn | II, IV | 118.0 | 59.0 |
| Tugsten (Wolfram) | W | IV, VI | 184.0 | 92.0 |
| Uranium | U | VI (IV) | 240.0 | 60.0 |
| Vanadium | V | III (V) | 51.2 | 51.2 |
| Ytterbium | Yt | IV | 172.6 | 17.1 |
| Yttrium | Y | II | 89.5 | 30.85 |
| Zinc | Zn | II | 65.0 | 32.5 |
| Zirconium | Zr | IV | 90.0 | 44.8 |

## ELSDEN'S TABLE OF POISONS AND ANTIDOTES.

| | Poisons. | Remarks. | Characteristic Symptoms. | Antidote. |
|---|---|---|---|---|
| Caustic Vegetable Alkalies. Acids. | Oxalic Acid. including Potassium Oxalate. | 1 dram is the smallest fatal dose known. | Hot, burning sensation in throat and stomach; vomiting, cramps, and numbness. | Chalk, whiting or magnesia, suspended in water. Plaster or mortar can be used in emergency. |
| | Ammonia. | Vapor of ammonia may cause inflammation of the lungs. | Swelling of tongue, mouth, and fauces; often followed by stricture of the œsophagus. | Vinegar and water. |
| | Potash. | | | |
| | Soda. | | | |
| Metallic Salts. | Mercuric Chloride. | 3 grains is the smallest knov. n fatal dose. | Acrid, metallic taste, constriction and burning in throat and stomach, followed by nausea and vomiting. | White and yolk of raw eggs with milk. In emergency, flour paste may be used. |
| | Acetate of Lead. | The sub-acetate is still more poisonous. | Constriction in the throat and at pit of stomach; crampy pains and stiffness of abdomen; blue line round the gums. | Sulphates of soda or magnesia. Emetic of sulphate of zinc. |
| | Cyanide of Potassium. | *a.* Taken internally, 3 grs. fatal. | Insensibility, slow, gasping respiration, dilated pupils, and spasmodic closure of the jaws. | No certain remedy; cold affusion over head and neck efficacious. |
| | | *b.* Applied to wounds and abrasures of the skin. | Smarting sensation. | Sulphate of iron should be applied immediately. |
| | Bichromate of Potas'um | *a.* Taken internally. | Irritant pain in stomach, and vomit'g. | Emetics and magnesia, or chalk. |
| | | *b.* Applied to slight abrasions of the skin. | Produces troubleso'e sores and ulcers. | |
| | Nitrate of Silver. | | Powerful irritant. | Common salt to be given immediately, followed by emetics. |
| Concentrated Mineral Acids. | Nitric Acid. | 2 drams have been fatal. Inhalation of the fumes has also been fatal. | Corrosion of windpipe and violent inflammation. | Bicarbonate of soda, or carbonate of magnesia or chalk, plaster of the apartment beaten up in water. |
| | Hydrochloric Acid. | ½ ounce has caused death. | | |
| | Sulphuric Acid. | 1 dram has been fatal. | | |
| | Acetic Acid, concentrated, has as powerful an effect as the mineral acids. | | | |
| | Iodine. | Variable in its action; 3 grains have been fatal. | Acrid taste, tightness about the throat, vomiting. | Vomiting should be encouraged, and gruel, arrowroot and starch given freely. |
| | Ether. | When inhaled. | Effects similar to chloroform. | Cold affusion and artificial respira'n. |
| | Pyrogallol. | 2 grains sufficient to kill a dog. | Resemble phosphorus poisoning. | No certain remedy. Speedy emetic desirable. |

## TREATMENT OF RESIDUES.

| NATURE OF WASTE. | TREATMENT. | RESULT OF OPERATION. | EXTRACTION OF PRECIOUS METAL. |
|---|---|---|---|
| Old hypo and fixing baths. | Add a small quantity of a strong solution of potassium sulphide, and silver will be precipitated in the form of a dense brown flucculent cloud; which stir, and allow to settle. | Collect the resulting precipitate of sulphide of silver, and allow to dry. | Mix with equal weight of sodium carbonate, 2 parts, potassium nitrate, 1 part, and fuse in a crucible |
| Solid residues (cuttings of silver paper, old filters, etc.). | Burn. | Collect the ashes. | Mix with equal weight of sodium carbonate, 2 parts, potassium nitrate, 1 part, and fuse in a crucible. |
| Old combined toning and fixing sulphocyanide baths. | Add a small quantity of hydrochloric acid and ferrous sulphate, which give a precipitate of metallic gold mixed with hydrous perchloride of iron. | Collect, and dry. | Fuse in a crucible to collect the gold and silver. |
| Old platinotype baths (oxalate of potassium). | Add to each liter (1,000 cc.) of old oxalate bath, 330 c.c. of a concentrated solution of sulphate of iron, and heat to boiling point. | The resulting black precipitate is pure platinum. | Collect, wash well, and dry on a filter. |
| Acid-fixing baths (platinotype process). | Add ferrous developing solution. | Metallic platinum is formed (mixed with small quantity of iron). | Eliminate the iron by treating with sulphuric acid, then wash. |
| Silver from sensitive films. | Place sensitized plates, etc., in 100 cc. of hydrochloric acid; pour the whole into a beaker, and add 100 c.c. of sulphuric acid, and heat. | Silver forms at the bottom of the beaker; allow to settle, and decant. | The residue is mixed with 5 parts of charcoal and 70 parts of sawdust, and heated to bright red in a crucible for an hour. A button of silver will be found at the bottom after the operation. |

## CHARACTERISTICS OF THE PRINCIPAL PHOTOGRAPHIC DEVELOPERS.

| Developer. | Color of Image. | Solubility. | Quantity Used in 1,000 c.c. of Water. | Used With. | Keeping Qualities. |
|---|---|---|---|---|---|
| Amidol. | Gray-black. | Soluble in water.<br>Slightly soluble in alcohol. | 5 grms. | Neutral sulphite soda and other alkalies. | Loses energy when it turns red. |
| Pyrocatechin (Kachin). | Bluish-gray. | Soluble in water, alcohol, and ether. | 5 to 15 grms. | Alkaline carbonates. | Slowly turns brown. |
| Eikonogen. | Gray-blue. | Soluble in warm water.<br>Very soluble in cold water.<br>Almost insoluble in alcohol or ether. | 10 to 30 grms. | Neutral sulphite with alkaline carbonates. | Turns brown when exposed to the air without losing its energy. |
| Glycin. | | Very soluble in water and alcohol.<br>Insoluble in ether. | | Caustic alkalies and carbonates. | |
| Hydroquinone. | Brown-black. | Very soluble in warm water, alcohol and ether; less soluble in cold. | 7 to 10 grms. | Caustic alkalies and carbonates. | Turns brown when exposed to the air without losing its energy. |
| Metol. | Gray-black. | Very soluble in water.<br>Soluble in alcohol and ether. | 5 grms. | Alkaline carbonates. | Keeps well. |
| Ortol. | | Very soluble in water.<br>Soluble in alcohol and ether. | | Alkaline carbonates. | |
| Paramidophenol. | Bluish. | Very soluble in water.<br>Slightly soluble in alcohol and ether. | 10 to 25 grms. | Carbonates and caustic alkalies. | Keeps well. |
| Pyrogallic Acid. | Brown-yellow. | Very soluble in water, alcohol and ether. | 5 to 10 grms. | Carbonates and ammonia. | Turns brown in the air. |
| Ferrous sulphate. | Yellowish. | Very soluble in water.<br>Insoluble in alcohol. | 100 to 300 grms. | Carbonates and ammonia. | Does not keep well. |

## UNITED STATES WEIGHTS AND MEASURES.

**According to Existing Standards.**

### LINEAL.

| | Inches. | Feet. | Yards. | Rods. | Fur's. | Mile. |
|---|---|---|---|---|---|---|
| 12 inches = 1 foot. | 12 = | 1 | | | | |
| 3 feet = 1 yard. | 36 = | 3 = | 1 | | | |
| 5.5 yards = 1 rod. | 198 = | 16.5 = | 5.5 = | 1 | | |
| 40 rods = 1 furlong. | 7,920 = | 660 = | 220 = | 40 = | 1 | |
| 8 furlongs = 1 mile. | 63,360 = | 5,280 = | 1,760 = | 320 = | 8 = | 1 |

### SURFACE — LAND.

| | Feet. | Yards. | Rods. | Roods. | Acres. |
|---|---|---|---|---|---|
| 144 sq. ins. = 1 sq. ft. | | | | | |
| 9 sq. ft. = 1 sq. yard. | 9 = | 1 = | | | |
| 30.25 sq. yds. = 1 sq. rod. | 272.25 = | 30.25 = | 1 | | |
| 40 sq. rods = 1 sq. rood. | 10,890 = | 1,210 = | 40 = | 1 | |
| 4 sq. roods = 1 acre. | 43,560 = | 4,840 = | 160 = | 4 = | 1 |
| 640 acres = 1 sq. mile. | 27,878,400 = | 3,097,600 = | 102,400 = | 2,560 = | 640 |

### VOLUME — LIQUID.

4 gills = 1 pint.
2 pints = 1 quart.
4 quarts = 1 gallon.

| Gills. | Pints. | Gallon. | Cub. In. |
|---|---|---|---|
| 32 = | 8 = | 1 = | 231 |

### FLUID.

| Gallon. | Pints. | Ounces. | Drachms. | Minims. | Cubic Centimetres. |
|---|---|---|---|---|---|
| 1 = | 8 = | 128 = | 1,024 = | 61,440 = | 3,785,435 |
| | 1 = | 16 = | 128 = | 7,680 = | 473,179 |
| | | 1 = | 8 = | 480 = | 29,574 |
| | | | 1 = | 60 = | 3,697 |

16 ounces, or a pint, is sometimes called a fluid pound.

### TROY WEIGHT.

| Pound. | Ounces. | Pennyweights. | Grains. | Grams. |
|---|---|---|---|---|
| 1 = | 12 = | 240 = | 5,760 = | 373.24 |
| | 1 = | 20 = | 480 = | 31.10 |
| | | 1 = | 24 = | 1.56 |

### APOTHECARIES' WEIGHT.

| lb. | ℥ | ʒ | ℈ | gr. | |
|---|---|---|---|---|---|
| Pound. | Ounces. | Drachms. | Scruples. | Grains. | Grams. |
| 1 = | 12 = | 96 = | 288 = | 5,760 = | 373.24 |
| | 1 = | 8 = | 24 = | 480 = | 31.10 |
| | | 1 = | 3 = | 60 = | 3.89 |
| | | | 1 = | 20 = | 1.30 |
| | | | | 1 = | .06 |

The pound, ounce, and grain are the same as in Troy weight.

### AVOIRDUPOIS WEIGHT.

| Pound. | Ounces. | Drachms. | Grains (Troy). | Grams. |
|---|---|---|---|---|
| 1 = | 16 = | 256 = | 7,000 = | 453.60 |
| | 1 = | 16 = | 437.5 = | 2.17 |
| | | 1 = | 27.34 = | 53.87 |

## ENGLISH WEIGHTS AND MEASURES.

### Apothecaries' Weight.

| | | | | |
|---|---|---|---|---|
| 20 Grains | = | 1 Scruple | = | 20 Grains. |
| 3 Scruples | = | 1 Drachm | = | 60 Grains. |
| 8 Drachms | = | 1 Ounce | = | 480 Grains. |
| 12 Ounces | = | 1 Pound | = | 5760 Grains. |

FLUID MEASURE.

| | | |
|---|---|---|
| 60 Minims | = | 1 Fluid Drachm. |
| 8 Drachms | = | 1 Fluid Ounce. |
| 20 Ounces | = | 1 Pint. |
| 8 Pints | = | 1 Gallon. |

The above weights are usually adopted in formulæ.

All Chemicals are usually sold by

### Avoirdupois Weight.

| | | | | |
|---|---|---|---|---|
| 27$\frac{11}{32}$ Grains | = | 1 Drachm | = | 27$\frac{11}{32}$ Grains. |
| 16 Drachms | = | 1 Ounce | = | 437½ Grains. |
| 16 Ounces | = | 1 Pound | = | 7000 Grains. |

Precious Metals are usually sold by

### Troy Weight.

| | | | | |
|---|---|---|---|---|
| 24 Grains | = | 1 Pennyweight | = | 24 Grains. |
| 20 Pennyweights | = | 1 Ounce | = | 480 Grains. |
| 12 Ounces | = | 1 Pound | = | 5760 Grains. |

Note.—An ounce of metallic silver contains 480 grains, but an ounce of nitrate of silver contains only 437½ grains.

### United States Fluid Measure.

| Gal. | | Pints. | | Ounces. | | Drachms. | | Mins. | | Cub. In. | | Grains. | | Cub. C. M. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | = | 8 | = | 128 | = | 1,024 | = | 61,440 | = | 231. | = | 58,328.886 | = | 3,785.44 |
| 1 | = | 16 | = | 128 | = | 7,680 | = | 28.875 | = | 7,291.1107 | = | 473.18 | | |
| 1 | = | 8 | = | 480 | = | 1.8047 | = | 455.6944 | = | 29.57 | | | | |
| 1 | = | 60 | = | 0.2256 | = | 56.9618 | = | 3.70 | | | | | | |

### Imperial British Fluid Measure.

| Gal. | | Pints. | | Ounces. | | Drachms. | | Mins. | | Cub. In. | | Grains. | | Cub. C. M. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | = | 8 | = | 160 | = | 1,280 | = | 76,800 | = | 277.27384 | = | 70,000 | = | 4,543.732 |
| 1 | = | 20 | = | 160 | = | 9,600 | = | 34.65923 | = | 8,750 | = | 567.966 | | |
| 1 | = | 8 | = | 480 | = | 1.73296 | = | 437.5 | = | 28.398 | | | | |
| 1 | = | 60 | = | 0.21662 | = | 54.96 | = | 3.550 | | | | | | |

## METRIC SYSTEM OF WEIGHTS AND MEASURES.

### MEASURES OF LENGTH.

| Denominations and Values. | | Equivalents in Use. | |
|---|---|---|---|
| Myriameter | 10,000 meters. | 6.2137 | miles. |
| Kilometer | 1,000 meters. | .62137 | mile, or 3,280 ft. 10 in. |
| Hectometer | 100 meters. | 328. | feet and 1 inch. |
| Dekameter | 10 meters. | 393.7 | inches. |
| Meter | 1 meter. | 39.37 | inches. |
| Decimeter | 1-10th of a meter. | 3.937 | inches. |
| Centimeter | 1-100th of a meter. | .3937 | inch. |
| Millimeter | 1-1000thof a meter. | .0394 | inch. |

### MEASURES OF SURFACE.

| Denominations and Values. | | Equivalents in Use. | |
|---|---|---|---|
| Hectare | 10,000 square meters. | 2.471 | acres. |
| Are | 100 square meters. | 119.6 | square yards. |
| Centare | 1 square meter. | 1,550. | square inches. |

### MEASURES OF VOLUME.

| Denominations and Values. | | | Equivalents in Use. | |
|---|---|---|---|---|
| Names. | No. of Liters | Cubic Measures. | Dry Measure. | Wine Measure. |
| Kiloliter or stere | 1,000 | 1 cubic meter. | 1.308 cubic yards. | 264.17 gals. |
| Hectoliter | 100 | 1-10th cubic meter. | 2 bu. and 3.35 pecks. | 26.417 gals. |
| Dekaliter | 10 | 10 cubic decimeters. | 9.08 quarts. | 2.6417 gals. |
| Liter | 1 | 1 cubic decimeter. | .908 quart. | 1.0567 qts. |
| Deciliter | 1-10 | 1-10th cu. decimeter. | 6.1023 cubic inches. | .845 gill. |
| Centiliter | 1-100 | 10 cubic centimeters. | .6102 cubic inch. | .338 fl. oz. |
| Milliliter | 1-1000 | 1 cubic centimeter. | .061 cubic inch. | .27 fl. drm. |

### WEIGHTS.

| Denominations and Values. | | | Equivalents in Use. |
|---|---|---|---|
| Names. | Number of Grams. | Weight of Volume of Water at its Maximum Density. | Avoirdupois Weight. |
| Millier or Tonneau | 1,000,000 | 1 cubic meter. | 2204.6 pounds. |
| Quintal | 100,000 | 1 hectoliter. | 220.46 pounds. |
| Myriagram | 10,000 | 10 liters. | 22.046 pounds. |
| Kilogram or Kilo | 1,000 | 1 liter. | 2.2046 pounds. |
| Hectogram | 100 | 1 deciliter. | 3.5274 ounces. |
| Dekagram | 10 | 10 cubic centimeters. | .3527 ounce. |
| Gram | 1 | 1 cubic centimeter. | 15.432 grains. |
| Decigram | 1-10 | 1-10th of a cubic centimeter. | 1.5432 grain. |
| Centigram | 1-100 | 10 cubic millimeters. | .1543 grain. |
| Milligram | 1-1000 | 1 cubic millimeter. | .0154 grain. |

*For measuring surfaces*, the square dekameter is used under the term of ARE; the hectare, or 100 ares, is equal to about 2½ acres. *The unit of capacity* is the cubic decimeter or LITER, and the series of measures is formed in the same way as in the case of the table of lengths. The cubic meter is the unit of measure for solid bodies, and is termed STERE. *The unit of weight* is the GRAM, which is the weight of one cubic centimeter of pure water weighed in a vacuum at the temperature of four deg. Cent. or 39.2 deg. Fahr., which is about its temperature of maximum density. In practice, the term cubic centimeter abbreviated c. c., is generally used instead of milliliter, and cubic meter instead of kiloliter.

### Freezing Mixtures.

| PARTS. Reducing the Temperature | From Degrees of the Celsius Thermometer | To |
|---|---|---|
| 3 Nitrate of sodium + 4 Water | + 13.2 deg. | — 5.3 deg. |
| 9 Phosphate of sodium + 4 dilute Nitric acid. | + 10 " | — 9 " |
| 3 Sulphate of sodium + 2 dilute Nitric acid.. | + 10 " | —10 " |
| 1 Nitrate of sodium + 4 Water | | —10.6 " |
| 1 Chloride of potassium + 4 Water | | —11.8 " |
| 5 Sal ammoniac + 5 Saltpetre + 16 Water | + 10 deg. | —12 " |
| 1 Nitrate of ammonia + 1 Water | + 10 " | —15.5 " |
| 8 Sulphate of sodium + 5 conc. Sulphuric acid | + 10 " | —17 " |
| 1 Sulphocyanate of Potass. + 1 Water | + 18 " | —21 " |
| 1 Chloride of sodium + 3 Snow | | —21 " |
| 1 Sal ammoniac + 1 Saltpetre + 1 Water | + 8 deg. | —24 " |
| 3 Crystal. chloride of calcium + 1 Snow | | —36 " |
| 1 Snow + 1 dilute Sulphuric acid | — 5 deg. | —41 " |

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### Antidote for Metol Poisoning.

There is a serious drawback to the use of Metol, as with some people it brings on an irritating skin trouble, leaving the fingers very sensitive and tender.

As a cure for this trouble, the following is recommended:

Take first Rochelle Salts to open the bowels, and next day use Swift's Special Specific, (S. S. S.) according to directions for scrofula. Attention should be paid to the general health, any tendency toward dyspepsia and constipation at once to be checked.

The following ointment is good and very healing:

| | |
|---|---|
| Ichthyol | 1 dram. |
| Lanoline | 2 drams. |
| Vaseline | 3 drams. |
| Boracic Acid | 2 drams. |

A drop of oil of lavender destroys the odor of the ichthyol and lanoline, and makes the ointment pleasant. It should be well rubbed into the skin, and at nights a good plan is to wear cotton gloves so that the ointment will not rub off nor stain the clothing. The ointment is also good for cuts and burns.

Another remedy, which, however, is rather severe, is to soak the hands in a strong solution of salt and vinegar for fifteen minutes. Do this twice daily for three or four days.

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### To Remove Stains from the Hands.

DEVELOPMENT STAINS.— Yield easily to the action of lemon juice.

NITRATE OF SILVER STAINS.— Prepare a solution of water 100 cc.; chloride of lime, 25 grms.; sulphate of soda, 50 grms. Apply with a tooth-brush.

PYRO STAINS.— Wash stained parts with a 10-per-cent. solution of oxalic acid.

AMIDOL STAINS.— Difficult to remove. Try citric acid.

NITRIC ACID STAINS.— Apply to stained parts a solution of permanganate of potash. Then wash freely.

**The Conversion of French (Metric) into English Measure.**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | cubic centimeter | = | 17 | minims. | | | | | | | |
| 1 | cubic centimeters | = | 34 | " | | | | | | | |
| 3 | " | = | 51 | " | | | | | | | |
| 4 | " | = | 68 | " | or | 1 | dram | 8 | minims. | | |
| 5 | " | = | 85 | " | " | 1 | " | 25 | " | | |
| 6 | " | = | 101 | " | " | 1 | " | 41 | " | | |
| 7 | " | = | 118 | " | " | 1 | " | 58 | " | | |
| 8 | " | = | 135 | " | " | 2 | drams | 15 | " | | |
| 9 | " | = | 152 | " | " | 2 | " | 32 | " | | |
| 10 | " | = | 169 | " | " | 2 | " | 49 | " | | |
| 20 | " | = | 338 | " | " | 5 | " | 38 | " | | |
| 30 | " | = | 507 | " | " | 1 | ounce | 0 | dram | 27 | minims. |
| 40 | " | = | 676 | " | " | 1 | " | 3 | drams | 16 | " |
| 50 | " | = | 845 | " | " | 1 | " | 6 | " | 5 | " |
| 60 | " | = | 1014 | " | " | 2 | ounces | 0 | " | 54 | " |
| 70 | " | = | 1183 | " | " | 2 | " | 3 | " | 43 | " |
| 80 | " | = | 1352 | " | " | 2 | " | 6 | " | 32 | " |
| 90 | " | = | 1521 | " | " | 3 | " | 1 | " | 21 | " |
| 100 | " | = | 1690 | " | " | 3 | " | 4 | " | 10 | " |
| 1000 | " | = | 1 liter = 34 fluid ounces nearly, or $2\frac{1}{8}$ pints. | | | | | | | | |

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**The Conversion of French (Metric) into English Weight.**

The following table, which contains no error greater than one-tenth of a grain, will suffice for most practical purposes:

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | gram | = | $15\frac{2}{5}$ | grains. | | | | | | |
| 2 | grams | = | $30\frac{4}{5}$ | " | | | | | | |
| 3 | " | = | $46\frac{1}{5}$ | " | | | | | | |
| 4 | " | = | $61\frac{4}{5}$ | " | ..... | or | 1 | dram | $1\frac{4}{5}$ | grain. |
| 5 | " | = | $77\frac{1}{5}$ | " | ..... | " | 1 | " | $17\frac{1}{5}$ | grains. |
| 6 | " | = | $92\frac{3}{5}$ | " | ..... | " | 1 | " | $32\frac{3}{5}$ | " |
| 7 | " | = | 108 | " | ..... | " | 1 | " | 48 | " |
| 8 | " | = | $123\frac{2}{5}$ | " | ..... | " | 2 | drams | $3\frac{2}{5}$ | " |
| 9 | " | = | $138\frac{4}{5}$ | " | ..... | " | 2 | " | $18\frac{4}{5}$ | " |
| 10 | " | = | $154\frac{2}{5}$ | " | ..... | " | 2 | " | $34\frac{2}{5}$ | " |
| 11 | " | = | $169\frac{4}{5}$ | " | ..... | " | 2 | " | $49\frac{4}{5}$ | " |
| 12 | " | = | $185\frac{1}{5}$ | " | ..... | " | 3 | " | $5\frac{1}{5}$ | " |
| 13 | " | = | $200\frac{3}{5}$ | " | ..... | " | 3 | " | $20\frac{3}{5}$ | " |
| 14 | " | = | 216 | " | ..... | " | 3 | " | 36 | " |
| 15 | " | = | $231\frac{2}{5}$ | " | ..... | " | 3 | " | $51\frac{2}{5}$ | " |
| 16 | " | = | 247 | " | ..... | " | 4 | " | 7 | " |
| 17 | " | = | $262\frac{2}{5}$ | " | ..... | " | 4 | " | $22\frac{2}{5}$ | " |
| 18 | " | = | $277\frac{4}{5}$ | " | ..... | " | 4 | " | $37\frac{4}{5}$ | " |
| 19 | " | = | $293\frac{1}{5}$ | " | ..... | " | 4 | " | $53\frac{1}{5}$ | " |
| 20 | " | = | $308\frac{3}{5}$ | " | ..... | " | 5 | " | $8\frac{3}{5}$ | " |
| 30 | " | = | 463 | " | ..... | " | 7 | " | 43 | " |
| 40 | " | = | $617\frac{1}{5}$ | " | ..... | " | 10 | " | $17\frac{1}{5}$ | " |
| 50 | " | = | $771\frac{3}{5}$ | " | ..... | " | 12 | " | $51\frac{3}{5}$ | " |
| 60 | " | = | 926 | " | ..... | " | 15 | " | 26 | " |
| 70 | " | = | $1080\frac{4}{5}$ | " | ..... | " | 18 | " | $0\frac{4}{5}$ | " |
| 80 | " | = | $1234\frac{3}{5}$ | " | ..... | " | 20 | " | $34\frac{3}{5}$ | " |
| 90 | " | = | 1389 | " | ..... | " | 23 | " | 9 | " |
| 100 | " | = | $1543\frac{1}{5}$ | " | ..... | " | 25 | " | $43\frac{1}{5}$ | " |
| 1000 | " | = | 1 kilogram = 32 oz., 1 dr., $12\frac{2}{5}$ gr. | | | | | | | |

# GENERAL INDEX

## VOLUME II.

The numbers in this index refer to paragraphs in all cases, excepting where the word "Page" precedes the number. (A) signifies that the reference will be found in the Appendix.

TAS, Fort Sill, Okla., (10-12-49—20,000)—6330