Information regarding this document.

The following PDF file was scanned and had ORC applied to those scans. I tried to go into the document and recreate the feel of the original document as close as possible. There is an error in the first page within the Berkely equation. This is part of the original document. There are some font changes from the original document which I believe to be the 15th Edition of Walls', THE ENCYCLOPÆDIC DICTIONARY OF PHOTOGRAPHY", pgs. 379 – 387.

(according to Berkely) take place

$$Fe_2(C_2O_4)_3 = 2FeC_2O_4 + 2\ CO_2$$

$$6Fe(C_2O_4).+ 3K_2PtCl_4 = 2\ Fe(C_2O_4) + Fe_2Cl_6 + 6\ KCl + 3Pt$$

It should read to be correct:

$$6Fe(C_2O_4) + 3K_2PtCl_4 = 2Fe_2(C_2O_4)3 + Fe_2Cl_6 + 6KCl + 3Pt$$

Note the missing 2, highlighted in red.

It should also be of interest that the mention of AFO, ammonium ferric oxalate, as well as SFO, sodium ferric oxalate are in this text which dates back to 1895; both mentioned as being part of the Zia system and The New platinum print, by Richard Sullivan and Carl Weese.

Eric Neilsen

PLATINOTYPE PROCESS.—A process of positive printing from the negative, giving pictures of remarkable softness and artistic quality. As far back as 1832 Sir J. Herschel gave an account of his experiments on the action of light upon salts of platinum. Later on in 1844 Hunt pointed out the fact that if a piece of paper be dipped in a solution of a platino-cyanide of potassium, and hung up to dry in the sun, no change was perceptible; but if after a short exposure it be treated with mercurous nitrate, a weak positive image was produced.

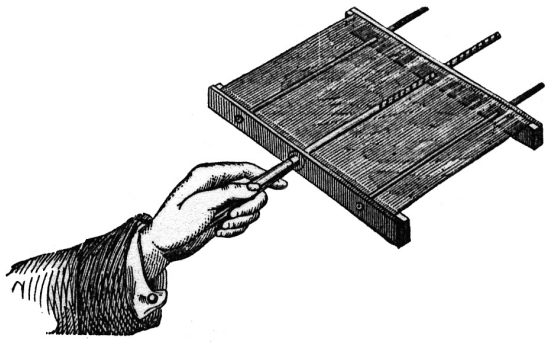

FIG. 348.—PLATE VISE.

The first practical platinum printing process was, however, invented and patented by Mr. Willis, of the Platinotype Co., and who supply all the necessary materials and the paper ready sensitized. Other processes are hereafter described, however, which may be worked by anyone

The principles of the process may be briefly stated as follows:——Paper is coated with a mixture of potassium chloroplatinite and ferric oxalate. The ferric oxalate is sensitive to light, becoming converted into ferrous oxalate; we therefore get a faint grayish orange-colored image of ferrous oxalate. Now, ferrous oxalate possesses the power when in solution of reducing potassium chloroplatinite to metallic platinum. It, therefore, only becomes necessary to dissolve the. ferrous oxalate in a suitable liquid, when the potassium chloroplatinite will be reduced to the metallic state as metallic platinum.

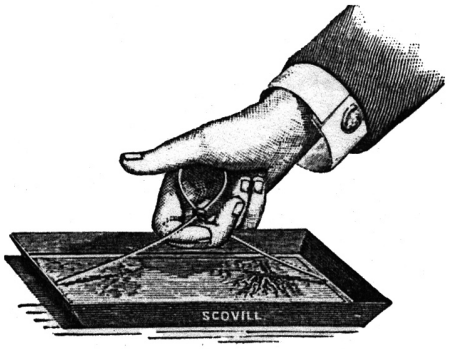

FIG. 349.—PLATE CLASP.

A solution of potassium oxalate possess this requisite power of dissolving the ferrous oxalate. The paper prepared with the chloroplatinite of potash having an image on. it of ferrous oxalate is, therefore, floated on this solution and. a picture consisting of finely divided metallic platinum is the result obtained. It then only becomes necessary to dissolve away the remaining iron salts by any suitable acid. The following reactions (according to Berkely) take place

$$Fe_2(C_2O_4)_3 = 2FeC_2O_4 + 2\ CO_2$$

$$6Fe(C_2O_4).+ 3K_2PtCl_4 = 2\ Fe(C_2O_4) + Fe_2Cl_6 + 6\ KCl + 3Pt$$

Metallic platinum being one of the most stable substances known, it is probable that prints by this process are absolutely permanent.

Preparation of the Paper—The paper is first treated with a size to prevent the sensitizing solution from sinking too deeply into it. A good stout paper is required of even texture and pure in color.

150 grains of moderately hard gelatine are dissolved in 30 ounces of water, and 45 grains of alum, together with seven ounces of pure methylated spirit, are added. This is then filtered into a, conveniently large dish, and the sheets passed through it one by one and hung up to dry. When dry it may be passed through a second time and dried. If arrowroot be used as the sizing browner tones are obtained in the finished prints.

Coating- the Paper.—The next operation is the coating of the paper with the sensitive solution. This should be done in a darkened room, care being taken that the sensitized paper be exposed for the shortest possible time. Lamplight, owing to its yellow color, is not suitable, as the coated parts cannot be easily distinguished from the uncoated.

Captain Pizzighelli and Baron Höbl in their work on the subject* give the following methods of preparing the paper, the variations being made to suit the different class of negatives. These two solutions are prepared—

No. 1.

Ferric oxalate	120 grains
Water	1 ounce
Oxalic acid	8 grains

No. 2.

No. 1 solution.....	1 ounce
Chlorate of potassium.....	2 grains

Considerable care must be taken that both these two solutions are protected from actinic light, otherwise the ferric salt will be speedily reduced to the ferrous salt.

* "Platinotype ,"by Captain Pizzighelli and Baron A. Hubl, translated by J. F. Iselin, and edited by Captain W de W. Abney, R.E., FRS

+ This can be detected by taking a few drops on a glass plate and mixing with it a drop of a solution of ferricyanide of potassium. If any blue coloration takes place there has been a reduction, and consequently the solution is unfit for use,

The sensitizing solution is prepared as follows:

Potassium chloroplatinite solution (80 grains to I ounce of water). .....24 drachms
No. I solution..... ..... 22 drachms
Distilled water .... 4 drachms

This should give very soft and deep black prints. If greater brilliancy is required the following- is recommended:

Chloro-platinite solution ....24 drachms
Solution No. I..... ..... 18 drachms
No. 2 .... 4 drachms
Distilled water.... .... 4 drachms

The next solution is recommended when results corresponding to silver images are required—

Chloro-platinite solution ....24 drachms
Solution No. I.. ..... 14 drachms
No. 2.... .... 8 drachms
Distilled water .... 4 drachms

For very weak negatives, reproductions of engravings, etc., use—

Chloro-platinite solution .... 24 drachms
No. 2..... ....22 drachms
Distilled water .... 4 drachms

The addition of the No. 2 or chlorate of potash solution increases the contrast, as it reduces a portion of the platinite into a platinic salt. It will be obvious, therefore, that by a judicious use of it brilliant prints may be obtained even from weak negatives. If the pictures possess no black shadows, as, for instance, in the reproduction of pencil drawings, the above mixtures may be diluted with half or even equal volumes of water. Distilled water should always be used.

Just before using, sufficient quantity of one of the mixtures given is prepared in a measuring glass for the size of the sheet of paper to be coated. For a sheet of paper 24 X 18, about two 1 ounces of the solution will be required. It is applied to the surface of the paper by means of a pad of cotton wool enclosed in a piece of soft flannel. The paper must be kept flat upon a level surface. A simple method is to stretch a long piece across a table, the ends overlapping, and having attached to them American clips tied to a kitchen poker or other suitable weight, as shown in Fig. 350. This will keep it taut, even as it expands with the application of the wet solution. The sensitizing solution is poured on and immediately spread over with the dabber, until the coating is as even as possible.

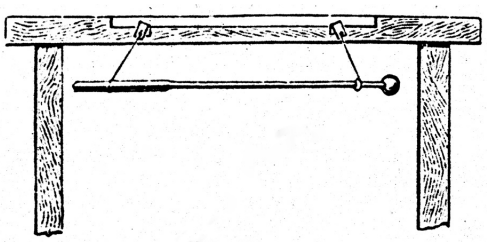

FIG. 350.

Drying the Paper — Considerable care must be exercised in this, as much of the subsequent success is dependent upon the operation.

Directly the sheet is coated it is hung up by its corners, until all the moisture on its surface has entirely disappeared. It is then" immediately dried before a fire or stove. When perfectly dry the lemon color of its surface will have changed to an orange-yellow. It should be dried perfectly without scorching, as this would produce fogged prints. It is of the utmost, importance that not less than five, nor more than ten minutes should elapse between the coating and the drying operations. If it becomes dried too soon the image will probably wash away in the developer, and if not dried quickly enough the picture will be flat and sunken in. In very warm weather the surface moisture will sometimes disappear in less than five minutes. In tills case the walls and floor must be sprinkled with water or the paper placed in a dampened cupboard.

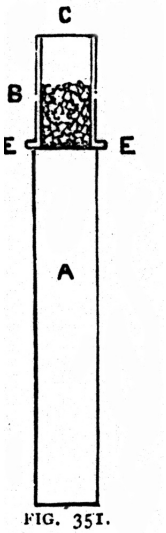

FIG. 351.

Keeping the Paper - When thoroughly dry the sheets of sensitive paper, and also the prints, are preserved in chloride of calcium boxes. Figs. 351 and 352 will serve to show the construction.

A is the compartment containing the paper. The cover B is divided into two parts, the lower part F which is placed on the top of the box consists of a cylinder perforated with holes, which slides into the box A, and serves to hold some lumps of dry calcium chloride wrapped up in calico or double fold of muslin. The upper part C serves to close up the top of the cylinder G. An elastic band E slips over the slots, and keeps them perfectly air tight. The calcium must be examined from time to time, if moist it must be changed for a fresh supply.* To secure the most brilliant results the sensitized paper before, during, and after exposure, must be kept dry as possible. The effect of damp is a want of vigor, muddy tones, and impaired purity of the whites.

The following instructions for platinotype printing are given by Platinotype. Co.

*Damp calcium chloride can be easily deprived of its moisture by heating in an iron vessel. It can then be used over again.

Printing.—Place the paper in the printing frame beneath the negative, and between it and the pad insert a sheet of thin vulcanized indiarubber, as it is of the first importance that the pads in contact with the paper be quite dry. The correct exposure (about one-third of that required with silver printing) is ascertained by inspection of the paper in a rather weak white light in the usual manner. A little experience will enable the exposure to be determined very accurately. The sensitized surface before exposure to light is of a lemon-yellow color. During exposure the parts affected by light become of a pale grayish-brown color, and sometimes of an orange tint under those parts of the negative which present clear glass or nearly so. As a general rule all parts of the picture except the highest lights should be visible when the exposure is complete. When examining the prints in the printing-frame care should be taken not to expose them unduly to light; for the degradation of the whites of the paper due to *slight* action of light is *not visible until after development.* Damp paper gives a less visible image than dry paper, hence it may easily be over-exposed. Remove prints to a calcium tube as soon as exposure is complete, unless they are to be at once developed.

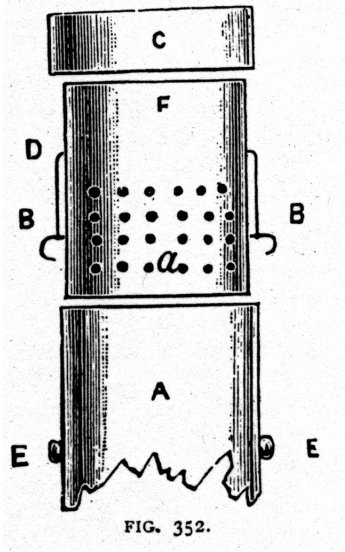

FIG. 352.

Development.—Development should be conducted in a feeble white light, similar to that used when cutting up the paper, or by gas light. It may take place immediately after the print is exposed, or at the end of the day's printing.

The developer is made by dissolving 1 lb. of oxalate of potash in 54 ounces of water. Used hot water for making the solution, of which a large quantity may be made up ; it will keep indefinitely. It is well to have at hand some unused solution, since, in the event of inferior prints being made, a new bath may at once be tried.

The solution is conveniently contained in a flat-bottomed dish of enameled iron, heated by a small spirit lamp or Bunsen burner for the smallest dish, or for the larger dishes a paraffin stove. Troughs for large prints are fitted with a tube gas-burner.

The developing tray recommended by Pizzighelli and Hiibl is shown in fig. 353. A is an enameled iron vessel containing the oxalate solution : a its cover of zinc plate; B is another hollow vessel, with a double wall of zinc plate, which acts as a water bath; C is a gas or spirit lamp. The vessel B is filled with hot water through a little hole let into the upper side, and hot solution of oxalate is then poured into the tray A ; it can readily be kept at the required temperature by means of the lamp underneath.

The development is effected by *floating the printed surface* of the paper for five or six seconds upon the "developing solution." To avoid air bubbles lay one edge of the print upon the solution near the right hand end of the dish; then, with a sliding motion towards the left, lower the print with an even movement, without stoppage, until it is entirely in contact with the liquid, where it must remain until *complete* action has taken place.

A good plan is to place the prints, after removal from the printing frames, in a calcium tube, with their printed surfaces outwards, and, therefore, convex. In a short time the prints will receive and retain this curvatur sufficiently for the developing operation. To develop take the print in the right hand (its printed surface being downwards), lay the left-hand edge on the developer, and then slowly and continuously lower the right hand until the whole print is floating. The great point is to well preserve, and if possible increase, the curvature of the paper as it near the liquid

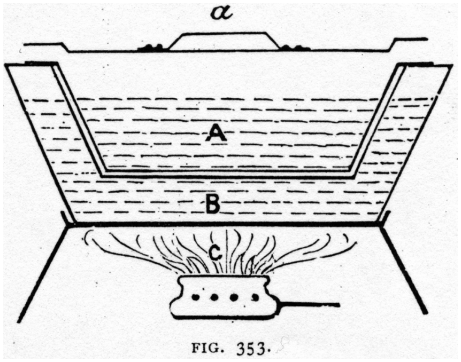

FIG. 353.

. A temperature of about 140 deg. Fahr. may be considered the standard temperature for the developer, though higher and lower temperatures may be used on occasion. To test the temperature a cheap chemical thermometer must be used. The bottom of the developing dish should be covered with the developing solution to the depth of *at least* one-half of an inch.

After the prints have been developed put the solution, without filtering, into a bottle for future use; it should not be exposed to a strong light. When next developing the solution will be found to be *nearly clear, but, of course, tinted by previous use*. If this clear solution be not sufficiente for use, add to it some of the fresh solution of the potassic oxalate. It is a safe plan always to keep the "bath solution" up to its orzginal bulk by this means. A little suspended matter in the bath is not of any consequence.

Sometimes, when a large number of prints (or large prints upon small bulk of solution) are developed at one operation, the bath will become so loaded with chemicals derived from the paper

that it will no longer give good prints. Such a solution must at once be replaced by a new one. When working on a somewhat large scale it is especially necessary to watch for any change in the quality of the prints; and in case of a doubt a new bath should be tried.

Very large prints may be developed without any difficulty in a trough, by being *slowly and continuously pulled through* the solution contained therein.

Clearing and Washing.—To clear the developed prints; these must be washed in a series of baths (not less than three) of a weak solution of hydrochloric acid. This solution is made by mixing i part of hydrochloric acid with 6o parts of water. The specific gravity of the acid should not be less than 1·16; if lower, more acid should be used. The acid should be colorless. Or citric acid, in the proportion of I ounce to 20 ounces of water, may be used This softens the paper in less degree than does the hydrochloric acid. *A white opalescence of the bath shows necessity for more acid.*

As soon as the print has been removed frem the developing dish it must be immersed face downwards in the first bath of this acid, contained in a porcelain dish, in which it should remain about five minutes; meanwhile, other prints follow until all are developed. The prints must then be removed to a second acid bath for about ten minutes; afterward to the third bath for about fifteen minutes. While the prints remain in these acid baths they should be moved so that the solution has free access to their surfaces, but care should be taken not to abrade them by undue friction. It is impossible to affect the image per sc by leaving the prints, for a long time in the acid baths, but such treatment continued for an hour or more tends to make the paper soft and porous, and to damage its surface.

The prints should not communicate to the last acid bath the slightest tinge of color. If the bath, after the prints have been washed in it, does not remain as colorless as water when a depth of fully two inches is viewed in full daylight, the prints should be. treated to yet another acid bath. The last acid bath must not in any case have been used for a previous batch of prints; after use it may form the first acid bath for the next batch, but it is better to replace all the baths by fresh ones. The object of this washing in dilute acid is to remove all traces of iron salts from the paper before it is placed in the plain water. . The prints must not be placed in plain water on leaving the developer, because insoluble salts will be precipitated on the print. After the prints have passed through the acid baths they should be well washed in two or three changes of water during about a quarter of an hour. It is sometimes advisable to add a pinch of washing soda to the second washing water to neutralize any acid present in the print.

Drying and Mounting.—After drying the prints are dried in the ordinary way. Any mountant can be used that does not show through the print. Gelatine alone is not suitable except for thick paper. Thick cold starch, or starch and gelatine, are the best mountants.

Platinum prints appear somewhat more brilliant and lighter when wet than when dry; therefore, if it has a correct appearance as regards tone when wet, it will be too dark when finished. Prints on smooth paper may be hot-pressed, which gives them a slight sheen, and brings up the dark parts. They may also be retouched with colors or chalk, their smooth, heavy surface serving well for this purpose.

The following list of defects and their remedies is given by Captain Pizzighelli and Baron Hübl:

1.—The pictures are vigorous, but more or less fogged.

(A) *cause*: The paper was affected by light either in sensitizing or printing.

To prevent it sensitize only under a weak light, and dry either in complete darkness or by lamplight. When examining the course of the copying operation be careful to avoid too strong a light in arranging the frame.

(B) *cause*: Too high a temperature in drying.

It should never exceed 40 deg. C.

(C) *cause*: Spoiled ferric solution.

The ferric solution is best preserved from the influence of light by being kept in a hyalite flask. If you are not confident as to your solution, you must assure yourself before using it by testing with red prussiate of potash that it is free from ferrite. Should it only contain a trace of ferrite it can be made fit for use again by carefully adding red prussiate of potash. In order to try this, mix a few cubic centimetres of the normal ferric chlorate solution with every 1oo cubic centimetres of the iron solution, and ascertain by actual experiment on paper whether the restoration is complete.

(D) *cause*: Too long exposure in the printing frame.

The time of copying should be shortened, and if the picture is not yet developed use a cold developer.

2.—The prints appear too weak under the developer.

(A) *cause*: Paper which has become damp.

The paper should always be kept in the calcium chloride boxes, even after being printed, if not immediately developed. Paper once spoiled cannot be made good again.

(B) *cause*: The paper is too old.

Paper can generally be kept in good condition for, at least, six or eight weeks, and some-

times even more; bitt after that time even a gradual change appears to take place, even though it be kept in the dark, and not only weak, but also fogged pictures are the result. As neither time nortrouble are required for sensitizing the paper, we recommend only to make at once as much as may be necessary for use during three or four weeks.

(C) cause: Weak negatives.

Use more chlorate of potash in the sensitizing solution.

3.—The prints come out vigorous in developing, but become weak after being dried.

Paper not sufficiently sized, for which reason the image sinks into its substance. When this is the case employ stronger solutions of gelatine or arrowroot.

(A) cause. Drying has been too slow.

The drying process should not take longer than ten minutes; if this is exceeded the sensitizing solution sinks too deeply into the paper.

4.—The whites of the prints have, after drying, a more or less yellowish tinge.

(A) cause: The sensitizing solution in the developer is not sufficiently acid. Attention should be paid to the instructions on this point in the previous divisions of the subject.

(B) cause: Insufficient immersion in hydrochloric acid.

The solution ot hydrochloric acid must be changed two or three times, until the last change no longer turns yellow at the end of ten minutes.

(C) cause: Paper blued with ultramarine, which, when treated with hydrochloric, turns yellow.

Before using the paper you must be certain that its color does not suffer from contact with a hot solution of oxalate, and from treatment with hydrochloric acid.

5.—The prints come out hard.

(A) cause: Exposure too short.

(B) cause. Too much in the sensitizing solution. Remedy obvious.

6.—Spots and streaks.

causes: Dirty brushes; touching the paper with wet fingers; dirty glass plates; vessels not kept clean, etc.

7.—Black spots.

(A) cause: Particles of metal embedded in the substance of the paper, causing a reduction of the platinum.

(B) cause: May be due to insoluble impurities in the chloroplatinite of potassium. These spots have a black nucleus, with an extension like the tail of a comet, of lighter color.

In such a case filter the sensitizing solution.

Platinotype prints may be made upon many other materials besides paper. Linen or other fabrics are treated in the same manner as paper. To keep smooth it should be stretched on a suitable frame after the second coating of the gelatine sizing solution. To print on wood it should be planed perfectly smooth and then coated with the g.elatine solution. Thin sheets should be kept between two boards to prevent them from warping.

Sepia Platinotype Paper.—This is a special paper prepared by the Platinotype Co. for giving sepia-toned pictures. It is believed that this result is obtained by the use of a salt of mercury with the platinum. With a few exceptions all the operations are similar to the ordinary kind of platinotype paper. The following special instructions are given :—

The sepia paper is more easily affected by faint light, and, therefore, increased care must be taken during the printing operation.

To develop, add to each ounce of the potassic oxalate solution one or two drachms of a special solution supplied for the purpose, and proceed as described for ordinary platinotype paper. The temperature should not exceed 150 degs. to xóo degs. Fahrenheit. The developing bath should be kept in the dark, and must on no account be used for black prints. Discoloration of the white of the image is due to one of the following causes—(I) Want of- sufficient "special solution" in the developer; (2) too much exposure of the developing solution to light; (3) use of a dish is which the enamel is cracked so as to expose the iron ; (4) paper kept too long ; (5) exposure of prints to too much light while clearing. The print are cleared with an acid bath of one part of hydrochloric acid (sp.gr. 1·16) to 6o parts of water. As the sepia prints, unlike the black ones, may be affected by light when in the acid bath, the lights being stained and degraded, the prints at this stage should be manipulated in a very weak light. The prints are damaged by being left long in the acid baths. The subsequent operations are the same as for the other kind of paper. Dishes used for sepii prints must not afterwards be used for developing black toned prints. Black and sepia prints must not be washed together in the same dish.

Cold-bath Process—A new method of platinotype printing introduced by Mr. Willis. The novel feature about this is that the platinum salt is used in the developing solution instead of in the paper. The following notes concerning it are given by the inventor:

Paper is coated with ferric oxalate and a small quantity of mercury salt, then exposed to the light, and afterwards developed on a cold solution containing potassic oxalate and potassic chloroplatinite. The solution of ferric oxalate employed is the same as that used in the present process, both as to the strength and acidity. In each ounce of this ferric salt is dissolved from 1 to

1 ¼ grains of salt of mercury, preferably the chloride. It is then dried perfectly, exposed to the action of light beneath a negative, then developed on a cold solution containing from 30 to 120 grains of oxalate of potash and from 5 to 15 grains of potassium chloroplatinite. The development proceeds sufficiently, slowly to allow of its being watched and stopped by immersion of the print in the acid clearing as soon as the desired strength of the deposit has been the attained. The following are the instructions given for working the paper as supplied by the Platinotype Company :

—

General Treatment of Paper.—This presence of moisture in the paper, either during its exposure to light, or afterwards and before development, is important. Excessive moisture is neither desirable nor useful. In England the moisture absorbed from the air of a cold room in winter during fifteen minutes is usually sufficient; or, in summer, about the same time in a dampish room. Sufficient moisture will he present when the paper has lost its crispness, but if allowed to become limp the moisture will be excessive. The best results are usually obtained when the paper has been damped before its exposure to light. But for reasons explained in the next section, beginners will find it better to expose in the dry state. If damped before exposure such damping should not long precede the printing.

Prints made by exposure to light of paper in a damp state, or made on dry paper and afterwards damped, will, if developed within an hour of such exposure, give the maximum of vigor, by delaying the development for some hours, the prints in the meantime being stored in a drawer wooden box, or other suitable receptacle, so that they will retain most of their moisture, then, on development, an increase of half-tone and increased warmth of color will be obtained. The modifications in the results to be secured in this way can be only roughly indicated ; the experience of the printer will very soon prevent mistakes.

But should it be necessary to delay development of prints for one or two days, they must be dried (not scorched) before a fire soon after they are removed from the frames, and then stored in a calcium tube until wanted for development.

As during printing operations no necessity exists for keeping paper dry, it is very advisable on account of the ease of manipulation, to employ drawers, or flat wooden or paper boxes. one to hold unexposed paper and another to receive exposed prints. The hinged paper boxes made for holding music answer very well for the smaller sizes. This method of working from non-metallic boxes also avoids the risk of spots due to metallic dust, which is always produced during the opening and closing of a calcium tube of tin or zinc.

Exposure to Light.—This is effected in a printing-frame in the usual manner. When exposed to light behind a negative, the lemon-color of the paper receives an image of a greyish tone. Some negatives, however, present such strong contrasts that the deep shadows on the print are carried beyond the gray stage and become of an orange-yellow; this state of the image is usually termed "solarization."

The exposure is somewhat less than that required with the old process—perhaps about one-third less. The progress of the printing is observed by opening the frame in the usual manner, but care should be taken to prevent undue access of strong light. As a general rule all details observable on the exposed print are developable, and the converse of this is also pretty generally true, namely, that no details are developable which are not also visible before development. But here it should be observed that the action of light on skies is not, often clearly seen unless the rebate of the negative has been previously rendered opaque by painting with opaque varnish, so that the tint of the sky may be compared with the original color of the paper which is preserved by the opacity of the "rebate." It is important to remember that if paper be exposed in a damp state the visibility of the image is less than if exposed in a dry state; the image is weaker in appearance and less of the detail in the high lights is seen. On this account beginners will find it easier to expose dry, and damp the prints afterwards. This paper is undoubtedly easier to expose correctly than paper made for the former processes, and no one should experience any difficulty after a small amount of practice has been gone through.

Development.—The developing agents are numerous, and a great variety of formule is possible. The best results are, however, obtained with mixtures of oxalates and hi-phosphates. The following is a good formula.:

A.

Oxalate of potash .....30 grains
Bi-phosphate of potash .....30 grains

Dissolved and made up with water to 1 ounce.

B.

Platinum salt .....30 grains
Water ....1 ounce
..

For use add one part of B to three parts of A, although a great many variations may be made in the proportions to which these two solutions are mixed to form the developer, and by these variations different effects are produced.

The mixed developer keeps in good condition for some hours after mixing, but it afterward slowly deteriorates, and in order to secure due economy in the use of the developer, it is important to mix no more at a time than is sufficient for the prints to be developed. In developing a very large batch, perhaps the best way is to mix the whole quantity necessary, but to put into the developing-dish only sufficient to render the floating of the prints an easy matter, and then to add the remainder by degrees, as may be found necessary.

In order to develop, pour sufficient of the developer into a porcelain tray to well cover the bottom, and then float the print, with its printed surface downwards, upon the solution; after the lapse of two or three seconds it may be lifted from the solution and held in the hand. A few seconds after the print has thus been removed from the developer, it should be again similarly floated and raised; and these operations may require to be repeated, but this will depend on the strength of the print or subject.

The object of re-floating the print is thus explained. When a print is first raised from the developer, the liquid adhering to its surface contains only a small quantity of platinum salt (the developer being weak in this ingredient), and the amount of salt so taken up is usually insufficient to supply the necessary quantity of platinum pigment to the shadows and darker parts of the print; by re-floating, a fresh supply of this pigment-forming liquid is supplied, and the number of floatings required is determined by the strength of the light impression.

After the print has been twice floated it should be held in the hand, face upwards, and the process of development carefully watched. When the half-tones have sufficiently appeared, and have become free from the granulation usually visible in the first stages of development, and the shadows also are sufficiently strong, the print should be at once immersed in the acid clearing bath. In some cases it takes a full minute to complete a development, but the moment selected for arresting it is to be decided by the taste and judgment of the operator. During the progress of the development it may sometimes be noticed that the shadows are slightly rusty in color, and appear to hang back. This indicates the necessity of another flotation on the developer. Or, instead of re-floating, some of the solution may be applied to the shadows by means of a large camel hair pencil.

A useful development, and one securing economy to small workers, is by means of a broad camel-hair brush, but it requires a little practice. The brush must be well wetted and the strokes given with fair rapidity. It is usually better to begin at the edge of a print and to let each succeeding stroke overlap the previous one, then, as soon as the print is covered, repeat the operation with strokes at right angles to the first series so as to render the coating as even as possible. The brush should be dipped in the developer before each stroke, or, at any rate, before every second one. And before beginning another print the brush should be washed in the developer in order to detach any salt which it may have derived from the previous print.

In using the floating method, air bells are sometimes formed on the surface of the print, but this only rarely happens when the surface is developed in its moist state. If any should appear on the print, after its first floating, they are best removed by again laying the print on the solution and then smartly sliding the print over the surface of the liquid.

A good method of floating is to lay one end or edge of the print upon the solution near the right-hand end of the dish; then, with a sliding motion towards the left, lower the print with an even movement, until it is entirely in contact with the liquid.

In order to avoid scum-marks on the prints it is very important to rock the developing lish between the development of each print. The rocking should be so managed that the developer is driven, in a wave, against the side of the dish, so that the surface scum may be broken up and sunk in the liquid.

Watzeck's .Platinotype Process.—Paper is coated with

Arrowroot	1 gramme
Cold saturated solution of sodium oxalate	50 c.c.

The solution is boiled until all sediment is dissolved. It is then applied to the paper two or more times, according to the porous nature of the paper.

For black tones the paper is sensitized in

Sat. sol. potassium chloroplatinite	5 C.C.
Sat. sol. double oxalate of soda and iron	8 c.c.
Sat. sol. potassium chlorate	3 drops

For sepia tones the following proportions are taken:

Sat. sol. potassium chloroplatinite	5 c.c.
Sat. sol. double oxalate of soda and iron	4 c.c.
Sat. sol. neutral oxalate of soda	3 c.c.
Sat. sol. mercuric chloride	1 c.c.
Sat. sol. potash chlorate	3 drops

More chlorate increases the contrasts and a smaller quantity of mercury gives darker tones. The solution of double oxalate of iron and soda is sensitive to light. The best results are obtained by drying the paper at a temperature of 35 deg. C.

Pizzighelli's Printing -out Platinotype Process.—A remarkable advance in platinum printing processes, introduced by Captain Pizzighelli, by which means the print is directly produced upon the platinum paper in the printing frame. The principles upon which the process is based are the following: (1.) By adding thickening materials to the sensitizing solution, the latter is prevented from penetrating the substance of the paper. (2.) If one of the substances used as a "developer" is added directly to the sensitizing solution, a reduction of the platinum salt takes place in the printing frame itself under the influence of the moisture of the air. The advantages of this process will be at once apparent. The previous preparation of the paper is dispensed with, and the progress of the printing can be watched, and, further, the developing process is also done away with.

Preparing the Paper.—The sort of paper to be selected is unsized photographic, smooth or rough, as supplied from Rives or Saxe or by Steinbach.

Solutions of gum arabic and arrowroot have been found the best substances for holding the sensitized liquid. These are prepared as follows:

No. 1.—GUM ARABIC SOLUTION.

Gum arabic (finest white lumps).....50 grammes
Distilled water..... .100 c.cm.

No. 2.—ARROWROOT SOLUTION.

Arrowroot ..... 2 grammes
Distilled water..... 150 c.c rn.

The arrowroot is kneaded into a paste with a little of the water, and the remainder added whilst boiling, the temperature to be kept up for some minutes. The gum arabic solution is said to give the best effects.

No. 3.—AMMONIUMFERRIC OXALATE SoLuTioN.

Ferric oxalate .....20 grammes
Oxalic acid..... 0.5 grammes
Ammonium oxalate .....I8 to 20 grammes
Distilled water .....150 c.cm.

No. 4.—SODIUM FERRIC OXALATE SOLUTION.

Ferric oxalate 20 grammes
Oxalic acid 0.5 grammes
Sodium oxalate 50 to 6o grammes
Distilled water ico c.cm.

The precise amount of sodium or ammonium oxalate necessary is determined by the color of the solution as the addition is slowly made. By formation of corresponding double salts the brownish gray color it at first assumes will change to a beautiful emerald green, and on a further addition of the salt it begins to get somewhat darker. Immediately this is observed the saturation is complete, and no more must be added. It should be mentioned that the addition of the sodium or ammonium oxalate should be made in the dark room. The mixture is then shaken up and filtered.

No. 5.—SENSITIZING SOLUTION.

Chloroplatinite of potassium solution (1 in 6)..... 24 c.cm.
No. 1 solution..... 22 c.cm.
No. 3 solution .....23 c.cm.

Or this—

Chioroplatinite of potash solution (1 in 6) 24 c.cm.
No. 1 solution .....22 c.crn.
No. 4 solution..... 23 c.cm.

Or the following—

No. 6.—SENSITIZING SOLUTION.

Chioroplatinite of potash..... 3 grammes
Sodium oxalate..... 3 grammes
Ferric oxalate .....4 grammes
Oxalic acid .....o.6 grammes
Gum arabic .....grammes
Distilled water..... 50 c.cm.

No. 5 gives bluish-black tones, and No. 6 is suitable when a more brownish color is desired. The mixture is well stirred up, filtered through muslin, and prepared from non-actinic light. The coating, drying, and storing of the paper are precisely the same as already described for the ordinary platinotype paper. About ninety minims of the liquid will be required for a piece of paper 10 x 8 inches.

Printing,----There are two or three methods of printing. By the first the action of the light is continued until all the image has appeared of the same depth of tone as required for the finished print. By the second method the printing is carried out until the image is all quite

visible as a whole, although the most delicate detail in the half-tones still remains wanting. The print is then removed from the printing frame and simply kept in the dark room. After a time, varying from half-an-hour to three or four hours, the print will be found to have completed itself, for the reason that the reduction of the platinum salts once started continues in the dark. Or, instead of laying aside to complete itself, the print may in this state be developed over with a cold solution made tip as follows:

Saturated solution of sodium carbonate .....5 cc.
Distilled water..... 1oo c.cm.

until all the finest details which are wanting have appeared. A third method of printing is to continue only as long as with the ordinary platinotype paper, that is to say, until the deepest shadows are distinctly visible. The image can then be developed with any of the ordinary platinotype developing solutions.

The prints (by whichever of the methods given above they are obtained) are placed in a dilute acid bath made up with—

Hydrochloric acid .....1 c.cm.
Water..... 80 c.cm.

and allowed to remain there until the yellow color of the paper has disappeared. They are then washed for from ten minutes to a quarter of an hour in several changes of clean water.

PLATINOUS CHLORIDE (Formula, $PtCl_2$; synonyms, *bichloride of platinum, chloroplatinous acid*).—Prepared by heating platinic chloride to 450 deg. F. and above, until it becomes insoluble in water. It forms a dingy green powder, also insoluble in nitric and sulphuric acids. It dissolves, however, in hot hydrochloric acid and in a solution of platinic chloride, yielding in the former a bright red, and in the latter a very dark reddish-brown solution. It dissolves in caustic potash, all the platinum being thrown down as platinum black on the addition of alcohol. It forms double salts with metallic chlorides. It is used in making potassium chloroplatinite for the platinotype process.

PLATINUM (Symbol, Pt; atomic weight, 197.4).—Platinum belongs to the group of noble metals in which gold, iridium, palladium, etc., are included. It is a white metal much resembling silver in appearance. It takes its name from plata, Spanish for silver. It possesses a specific gravity of 21.5 and usually occurs in the free state. It is obtained chiefly in Mexico, Brazil, and Siberia, and from copper ore found in the Alps. In a fine state of division it is absolutely black. Its chief properties are its exceptional stability, which is superior to gold, and its non-oxidation at any temperature. It cannot be attacked by any single acid and only slightly by a few alkaline substances.

Platinum is now considered to be tetratomic, or, in other words, its atom requires four atoms of any univalent element to. form the molecule. Formerly it was considered to be divalent, and the term bichloride of platinum is still applied to what is in reality the tetrachloride.

Platinum is now extensively used in photography in the different platinotype processes and in platinum toning.

PLATINUM CIILORIDES.—_Platinum forms two chlorides, platinic chloride and platinous chloride (q. v.)

PLATINUM CYANIDE.—The cyanides of platinum have not been prepared in a pure state, but the salts known as platino-cyanides exceed the ferro-cyanides in the force with which they retain the platinum distinguished by the ordinary tests for it.†

PLATINUM PERCHLORIDE.--See Platinum Tetrachloride.

PLATINUM PROCESS.—See Platinotype.

PLATINUM TETRACHLORIDE (Formula, $PtCl_4$ synonyms, *platinum perchloride, muriate of platina, platinic chloride*).—A salt prepared from metallic platinum by heating with aqua reg-ra and evaporating. It occurs in small brownish-red masses, which, if pure, dissolve readily in water, forming a deep orange or brownish-orange solution. According to Pizzighelli the chloride of platinum sold by dealers in fifteen grain tubes is really chloroplatinic acid $PtC1_4$ 2HC1. It is a fact that it certainly possesses a large percentage of free hydrochloric acid. It is used chiefly in platinum toning.

PLATINUM TONING.—-As is generally known the chief substance used in photography for toning the photographic image to an agreeable color is gold. The chemical similarity between gold and platinum led to experiments being made with the latter metal to replace the former. The first published formula for a platinum toning process was given in " La Lumière" (Feb.;

* Aqua regia (a mixture of nitric'and hydrochloric acid) will dissolve it slowly, forming chioroplatinic acid.

† Bloxham's "Chemistry," page 624.