

ordinary lens upright. You must have a considerable rising front for all such pictures. Mine shifts three inches for upright views, and nearly two inches for oblong pictures (I got extra screw holes put in), and this is frequently not sufficient without tilting.

The interior views of the Abbey are only limited by time. Decidedly stop here a night at least, and do Chepstow Castle in a half-day—morning being best. Four plates, or six at the utmost, are sufficient for Chepstow—one from the bridge, others close, and interior. Only the entrance can be done outside; there is no use of going to the back, as there are too many trees. At Tintern we stopped at Walnut Cottage, and if anybody desires to meet with real kindness, let him go there too; but don't expect luxuries.

We went next to Raglan. It is a fine drive across the country, but we went, for economy's sake, by rail. The delay en route at Monmouth affords an opportunity for taking Troy House, mentioned before, and the town, hills, and river from the railway bridge.

Raglan Castle is but a short walk from the station of that name, and no conveyances meet the trains. If you order one, you pay 2s. 6d., and the driver, for less than a mile's drive. Here also you must wait the effects of the morning and afternoon's sun to secure the best results. I prefer the morning if only one half the day can be spared; but it is well worth spending the whole day there. Here, again, a short-focus lens is useful; you can work with the other, but get no sky or foreground. The lens I carry for this purpose is a wide-angle rectilinear, and so wide that special care must be taken not to be taken in—I mean in the picture. In three cases I find myself too obtrusive in one; the whole head and face is distinct, although so close. While on this subject it may be a hint to some who want an "object" in the foreground sometimes to tell an old dodge. With the ordinary rapid rectilinear I use a drop shutter frequently, one of my own make, and held in position by a common pin; then, when the "object" is required, and no figure handy, tie one end of a reel of cotton to the pin's head, and unravel till the operator is in position. A pull at the cotton, and the exposure is complete. You will see an example of this among those exhibited to-night. The wide-angle rectilinear gives first-class views with single lens merely, but suitable only for landscapes, being so slow. The village of Raglan contains two or three "bits," and the church interior contains, I am told, some good monuments.

Further down this line is Pontypool, and the great viaduct, but we branched off at the junction and stopped again at Usk—a clean little town of no interest, but there is a good river and fine open valley. One of my best views was taken from a hill south of the town, overlooking the river, town, bridge, and castle—a good combination—and some fine natural clouds, which I did not expect. Usk Castle is not worth the climb up as it is only a husk. From here we went to Abergavenny, which is surrounded by fine hills and river scenery. There is an old ruined castle here, too, but we did not stop more than two or three hours. We had intended to go on to Brecon—one of the prettiest-situated towns in this district, but could not; so returned by the same route home.

I exposed about five dozen plates, not including figure studies, and do not regret one, except those spoilt by my own carelessness. The trip abounds in beauties of the most varied character, many of which, from want of strength, were denied to me. The whole could be accomplished in a week easily, or plenty of other places could be added to prolong it—South Wales, Wells, and Glastonbury, southwards; Warwick, Kenilworth, and Stratford-on-Avon could be taken on the journey home.

The above is but a brief summary of our journey. I did not mention the Wyndcliffe, at Tintern—another centre of attraction, as there is a magnificent view from the summit.

To us, who are constantly on the look-out for photographic trips, records of this class are valuable. How many who go away even mention where they have been! Mr. Day has suggested, and I beg to second the proposition, that we keep an excursion book for every member to enter his experiences in. This book to be kept for reference at any time. This could be made exceedingly valuable if the details of large districts were specified, and the time of day suitable for each. It is so easy to go to a locality and entirely miss the best points if not instructed beforehand; and, on the other hand, it would tend to save much valuable time by knowing which direction to take for morning views, and which for evening.

COMPOSITE PORTRAITURE.

BY FRANCIS GALTON, F.R.S.*

I PROPOSE to draw attention to-night to the results of recent experiments and considerable improvements in a process of which I published the principles three years ago, and which I have subsequently exhibited more than once.†

I have shown that, if we have the portraits of two or more different persons taken in the same aspect, and under the same conditions of light and shade, and that if we put them into different optical lanterns converging on the same screen, and carefully adjust them—first, so as to bring them to the same scale, and, secondly, so as to superpose them as accurately as the conditions admit—then the different faces will blend surprisingly well into a single countenance. If they are not very dissimilar, the blended result will always have a curious air of individuality, and will be unexpectedly well defined; it will exactly resemble none of its components; but it will have a sort of family likeness to all of them, and it will be an ideal and an averaged portrait. I have also shown that the image on the screen might be photographed then and there, or that the same result may be much more easily obtained by a method of successive photography, and I have exhibited many specimens made on this principle. Photo-lithographs of some of these will be found in the Proceedings of the Royal Institution, as illustrations of a lecture I gave there "On Generic Images" in 1879.

It will be convenient that I should again explain the best of the many processes that I have already published. It is simple enough in idea, but difficult to carry out with the scrupulous accuracy of adjustment that is needed for really good results. I have, therefore, little doubt that some photographers may have tried it, or some other of my plans, and failed, and that they consequently have abandoned what I believe is likely to become a new and not unimportant branch of their art. I will exhibit and explain the apparatus as it stands, and will indicate some improvements as I go on. The apparatus is here. I use it by gaslight, and employ rapid plates, which, however, under the conditions of a particularly small aperture, and the character of the light, require sixty seconds of total exposure. The apparatus is 4 feet long and 6½ inches broad; it lies with its side along the edge of the table at which I sit, and it is sloped towards me, so that, by bending my neck slightly, I can bring my eye to an eyehole, where I watch the effect of the adjustments which my hands are free to make. The entire management of the whole of these is within an easy arm's length, and I complete the process without shifting my seat.

The apparatus consists of three parts, A, B, and C. A is rigidly fixed; it contains the dark slide and the contrivances by which the position of the image can be viewed; the eyehole, *c*, already mentioned, being part of A. B is a travelling carriage that holds the lens, and is connected by bellows-work with A. In my apparatus it is pushed out and in, and clamped where desired, but it ought to be moved altogether by pinion and rack-work. The lens I use is an I B Dallmeyer. Its focal length is appropriate to the size of the instrument, and I find great convenience in a lens of wide aperture, when making the adjustments, as now I require plenty of light; but as to the photography, the smaller the aperture the better. The hole in my stop is only two-tenths of an inch in diameter, and I believe one-tenth would be better.‡

* Read before the Photographic Society of Great Britain.

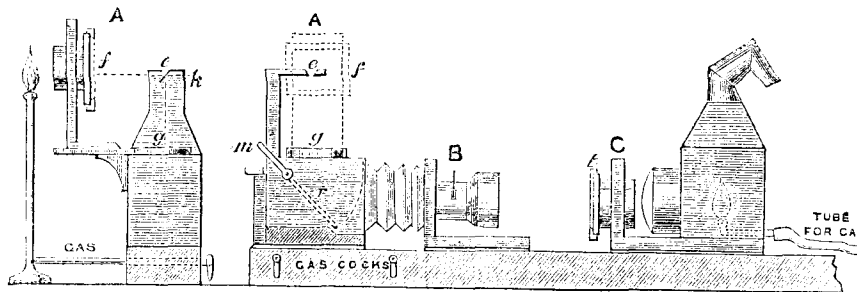
† "Composite Portraits," Journal of the Anthropological Institute, 1878, reprinted in *Nature* and in the PHOTOGRAPHIC NEWS, and translated in the *Revue Scientifique*. Also "Generic Images," Proceedings of the Royal Institution, 1879.

‡ A small aperture helps to remove a cause of fog, due to the source of illumination not lying in the same plane as the transparency, but behind it. Suppose an isolated black dot, *p*, in the transparency—call its image on the focussing-screen *m*; let the point in the illuminated surface that lies in the prolongation of *m p* be called *p'*. Then, to produce an image free from fog, every ray proceeding from *p* towards the lens ought to be intercepted by *p*. This, however, can never be the case under the above conditions. Since *m* is in focus for rays proceeding from *p*, the focus for rays proceeding from the more distant point *p'*, will be somewhere in front of *m*. Consequently those rays from *p'* that skirt *p*, and that fall upon the outer portion of the lens, will be brought to a focus in front of *m*; they will diverge as they proceed further, and will form a blur of light that will over-spread *m*; in short, they will cause fog. Owing to this cause, we cannot have perfect sharpness in any contour line in the image of a transparency that is illuminated by a mirror reflecting the light of the sky, or by a distant sheet of white paper. The remedy is two-fold: one part consists in bringing the source of illumination as near as possible to the transparency, and the other is to use a very small aperture. I rest the transparency against a ground-glass plate, not too strongly illuminated from behind, and which itself becomes the source of illumination. I do not like to put the face of the transparency against the face of the ground glass without introducing certain other difficulties; thus the image somewhat loses its definition, and

C is a travelling carriage that supports the portraits in turn, from which the composite has to be made. I work directly from the original negatives with transmitted light; but prints could be used with light falling on their face. For convenience of description I will confine myself to the first instance only, and will therefore speak of C as the carriage that supports the frame that holds the negative transparencies. C can be pushed along the board and be clamped anywhere, and it has a rack and pinion adjustment; but it should have been made movable by rack and

pinion along the whole length of the board. The frame for the transparencies has the same movements of adjustment as those in the stage of a microscope. It rotates round a hollow axis, through which a beam of light is thrown, and independent movements in the plane, at right angles to the axis, can be given to it in two directions, at right angles to one another, by turning two separate screws. The beam of light is furnished by three gas-burners, and it passes through a condenser. The gas is supplied through a flexible tube that does not interfere with the move-

DIAGRAM SHOWING THE ESSENTIAL PARTS.



- A The body of the camera, which is fixed.
- B Lens on a carriage, which can be moved to and fro.
- C Frame for the transparency, on a carriage that also supports the lantern; the whole can be moved to and fro.
- r The reflector inside the camera.
- m The arm outside the camera attached to the axis of the reflector; by moving it, the reflector can be moved up or down.
- g A ground-glass screen on the roof, which receives the image when the reflector is turned down, as in the diagram.
- e The eye-hole through which the image is viewed on *g*; a thin piece of glass immediately below *e* reflects the illuminated fiducial lines in the transparency at *f*, and gives them the appearance of lying upon *g*—the distances *f k* and *g k* being made equal, the angle *f, k, g* being made a right angle, and the plane of the thin piece of glass being made to bisect *f, k, g*.
- f Framework, adjustable, holding the transparency with the fiducial lines on it.
- t Framework, adjustable, holding the transparency of the portrait.

ments of C, and it is governed by a stop-cock in front of the operator.

The apparatus, so far as it has been described with any detail, and ignoring what was said about an eye-hole, is little else than a modified copying camera, by which an image of the transparency could be thrown on the ordinary focussing-screen, and be altered in scale and position until it was adjusted to fiducial lines drawn on the screen. It is conceivable that this should be done, and that the screen should be replaced by the dark slide, and a brief exposure given to the plate; then, that a fresh transparency should be inserted, a fresh focussing adjustment made, and a second exposure given, and so on. This, I say, is conceivable, but it would be very inconvenient. The adjusting screws would be out of reach; the head of the operator would be in an awkward position; and though these two difficulties might be overcome in some degree, a serious risk of an occasional shift of the plate during the frequent replacement of the dark slide would remain. I avoid all this by making my adjustments while the plate continues in position with its front open. I do so through the help of a reflector, temporarily interposed between it and the lens. I do not use the ordinary focussing-screen at all in making my adjustments, but one that is flush, or nearly so, with the roof of the camera. When the reflector is interposed, the image is wholly cut off from the sensitized plate, and is thrown upwards against this focussing-screen, *g*. When the reflector is withdrawn, the image falls on the plate. It is upon this focussing screen in the roof that I see the fiducial lines by which I make all the adjustments. Nothing can be more convenient than the position of this focussing-screen for working purposes. I look down on the image as I do upon a book resting on a sloping desk, and all the parts of the apparatus are within an easy arm's length.

My reflector in my present instrument is, I am a little ashamed to confess, nothing better than a piece of looking-glass fixed to an axle within the camera, near its top left-hand edge. One end of the axle protrudes, and has a short arm; when I push the arm back, the mirror is raised; when I push it forward, it drops down. I used looking-glass because the swing action is very true, and as my apparatus was merely a provisional work-

ing model, made of soft wood, I did not like to use sliding arrangements, which might not have acted truly, or I should certainly have employed a slide with a rectangular glass prism, on account of the perfect reflection it affords. And let me say, that a prism of two inches square in the side is quite large enough for adjustment purposes, for it is only the face of the portrait that is wanted to be seen. I chose my looking-glass carefully, and selected a piece that was plane and parallel. It has not too high a polish, and therefore does not give troublesome double reflections. In fact, it answers very respectably, especially when we consider that perfection of definition is thrown away on composites. I thought of a mirror silvered on the front of the glass, but this would soon tarnish in the gas-light, so I did not try it. For safety against the admission of light unintentionally, I have a cap to the focussing screen in the roof, and a slide in the fixed body of the instrument immediately behind the reflector, and before the dark slide. Neither of these will be wanted when the reflector is replaced by a prism, set into one end of a sliding block that had a large horizontal hole at the other end, and a sufficient length of solid wood between the two to block out the passage of light both upwards and downwards, whenever the block is passing through the half-way position.

As regards the fiducial lines, they might be drawn on the glass screen; but black lines are not, I find, the best. It is far easier to work with illuminated lines; and it is important to be able to control their brightness. I produce these lines by means of a vertical transparency, set in an adjustable frame, connected with A, and having a gaslight behind it. Below the eyehole *e*, through which I view the glass screen *g*, is a thin piece of glass set at an angle of 45°, which reflects the fiducial lines and gives them the appearance of lying on the screen, the frame being so adjusted that the distance from the thin piece of glass to the transparency and to the glass screen *g* is the same. I thus obtain beautiful fiducial lines, which I can vary from extreme faintness to extreme brilliancy, by turning the gas higher or lower, according to the brightness of the image of the portrait, which itself depends on the density of the transparency that I am engaged upon. This arrangement seems as good as can be. It affords a gauge of the density of the negative, and enables me to regulate the burners behind it, until the image of the portrait on *g* is adjusted to a standard degree of brightness.

(To be continued.)

the grain of the ground glass, or any dust on its surface, is photographed with unwelcome precision. As for the aperture, I use a stop hole in which is too small to admit an ordinary lead pencil.

works were laid upon the table at the meeting. The first of these is a "Manual of Manipulation with Carbon Tissue and Transfer Paper," by M. A. Lamy. This is, in fact, a complete treatise on carbon printing, full of minute details, described with great clearness by a very skilful operator, whose advice, the fruit of a long and active experience, deserves not only to be listened to, but to be taken. The treatise will, perhaps, be of more use to the amateur than to the professional photographer, as the work of the latter has to be executed more quickly and on a larger scale than that described by M. Lamy; but for amateur work, the description of the arrangement of the laboratories, and the great attention paid to minute precautions, render the book a very valuable one. Such a practical manual as this cannot fail to develop the employment of the carbon process. The second work is a treatise "On the Woodbury Process," by M. Léon Vidal, published by M. Gauthier-Villars. Concerning my own work I naturally can say nothing, except that a book of the kind was greatly needed. My desire has been to meet a want, and also to popularize acquaintance with a method of printing too little known, and up to the present too little practised. The recent improvements introduced by Mr. Woodbury will have a powerful effect in promoting my efforts. This said, I can only submit my work to the kind appreciation of the public, to whom the rôle of critic naturally belongs.

Museum of Photography in connection with the Conservatoire des Arts et Métiers.—A photographic museum is just now in course of being established at the *Conservatoire des Arts et Métiers*. M. Hervé-Mangon, the director of this well-known institution, has selected specimens of all the different processes which are deserving of notice. A special court has been set apart for them, where they will be exhibited, each with a label describing the nature of the process and the name of the inventor. This is a very happy idea, and by means of it photography will find a place in all our museums and collections. I cannot praise too highly attempts of the kind, and I hope that this special museum will be methodically arranged, and will continue to be made more complete by the addition of new processes as they make their appearance.

Examination of Photographic Assistants for Certificates.—The project of establishing a technical school for photographic operators, which had been entertained by the *Chambre Syndicale de Photographie*, has been abandoned, so many difficulties were found in realizing it. The hope of ultimately attaining the object in view, however, has not been entirely given up, and a commencement will be made by holding examinations of photographic assistants. Those who pass these examinations will receive certificates of different degrees. Candidates of any nationality will be admitted to the examinations, and the plan itself is so far organized that it will soon be published. I can hardly foretell what measure of success this project will meet with, but at any rate we can say that it can do no harm, even should it not be able to do good. It certainly deserves to be carried out as far as possible, for if it should be successful, it would provide professional photographers with assistants whom they can trust as knowing something of their art, and the best of whom will no doubt find places in the principal photographic establishments. LEON VIDAL.

COMPOSITE PORTRAITURE.

BY FRANCIS GALTON, F.R.S.*

For convenience in enlarging or reducing, I take care that the intersection of the vertical fiducial line with that which passes through the pupils of the eyes shall correspond to the optical axis of the camera. Then, as I enlarge or reduce, that point in the image remains fixed. The uppermost horizontal fiducial line continues to intersect the pupils, and the vertical one continues to divide the face symmetrically. The mouth has alone to be watched. When the mouth is adjusted to the lower fiducial line,

the scale is exact. It is a great help having to attend to no more than one varying element. The only inconvenience is that the image does not lie in the best position on the plate when the point between the eyes occupies its centre. This is easily remedied by using a larger back with a suitable inner frame. I have a more elaborate contrivance in my apparatus to produce the same result, which I need not stop to explain.

For success and speed in making composites, the apparatus should be solidly made, chiefly of metal, and all the adjustments ought to work smoothly and accurately. Good composites cannot be made without very careful adjustment in scale and position. An off-hand way of working produces nothing but failures.

I will first exhibit a very simple but instructive composite effect. I drew on a square card a circle of about 2½ inches in diameter, and two cross lines through its centre, cutting one another at right angles. Round each of the four points, 298 apart, where the cross cuts the circle, I drew small circles of the size of wafers, and gummed upon each a disc of different tint. Finally, I made a single black dot half-way between two of the arms of the cross. I then made a composite of the four positions of the card, as it was placed successively with each of its sides downwards. The result is a photograph having a sharply-defined cross surrounded by four discs of precisely uniform tint, and between each pair of arms of the cross there is a very faint dot. This photograph shows many things. The fact of its being a composite is shown by the four faint dots. The equality of the successive periods of exposure is shown by the equal tint of the four dots. The accuracy of adjustment is shown by the sharpness of the cross being as great in the composite as in the original card. We see the smallness of the effect produced by any trait, such as the dot, when it appears in the same place in only one of the components; if this effect be so small in a series of only four components, it would certainly be imperceptible in a much larger series. Thirdly, the uniformity of resulting tint in the composite wafer is quite irrespective of the order of exposure. Let us call the four component wafers A, B, C, D, respectively, and the four composite wafers 1, 2, 3, 4; then we see, by the diagram, that the order of exposure has differed in each case.

Composite.	Successive Places of the Components.									
	1	2	A	B	D	A	C	D	B	C
4	3	D	C	C	B	B	A	A	A	D

In 1 it has been A, D, C, B,
 " 2 " " B, A, D, C,
 " 3 " " C, B, A, D,
 " 4 " " D, C, B, A.

Yet the result is identical. Therefore the order of exposure has no effect on the result.

I will next show a series consisting of two portraits considerably unlike to one another, and yet not so very discordant as to refuse to conform, and of two intermediate composites. In making one of the composites I gave two-thirds of the total time of exposure to the first portrait, and one-third to the second portrait. In making the other composite, I did the converse. It will be seen how good is the result in both cases, and how the likeness of the longest-exposed portrait always predominates.

The next is a series of four composites. The first consists of fifty-seven hospital patients, suffering under one or other of the many forms of consumption. I may say that, with the aid of Dr. Mahomed, I am endeavouring to utilize this process to elicit the physiognomy of disease. The composite I now show is what I call a hotch-potch composite; its use is to form a standard whence deviations towards any particular sub-type may be conveniently gauged. It will be observed that the face is strongly marked, and that it is quite idealised. I claim for composite portraiture, that it affords a method of obtaining pictorial averages, which effects simultaneously for every point in a picture what a method of numerical averages would do for each point in the picture separately. It gives, in short, the average tint of every unit of area in the picture, measured from the fiducial line as co-ordinates. Now every statistician knows, by experience, that numerical averages usually begin to agree pretty fairly when we deal with even twenty or thirty cases. Therefore we should expect to find that any groups of twenty or thirty men of the same class would yield composites bearing a considerable likeness to one another. In proof that this is the case, I exhibit three other composites—the one is made from the first twenty-eight

* Continued from page 317.

portraits of the fifty-seven, the second from the last twenty-seven, and the third is made from thirty-six portraits taken indiscriminately out of the fifty-seven. It will be observed that all the four composites are closely alike.

I will now show a few typical portraits I selected out of eighty-two male portraits of a different series of consumptive male patients; they were those that had more or less of a particular wan look that I wished to elicit. The selected cases were about eighteen in number, and from these I took twelve, rejecting about six as having some marked peculiarity that did not conform well with the remaining twelve. The result is a very striking face, thoroughly ideal and artistic, and singularly beautiful. It is, indeed, most notable how beautiful all composites are. Individual peculiarities are all irregularities, and the composite is always regular.

I show a composite of fifteen female faces, also of consumptive patients, that gives somewhat the same aspect of the disease; also two others of only six in each, that have in consequence less of an ideal look, but which are still typical. I have here several other typical faces in my collection of composites; they are all serviceable as illustrations of this memoir; but, medically speaking, they are only provisional results.

It will be asked, of what use can all this be to ordinary photographers, even granting that it may be of scientific value in ethnological research, in inquiries into the physiognomy of disease, and for other special purposes? I think it can be turned to most interesting account in the production of family likenesses. The most unartistic productions of amateur photography do quite as well for making composites as those of the best professional workers, because their blemishes vanish in the blended result. All that amateurs have to do is to take negatives of the various members of their families in precisely the same aspects (I recommend either perfect full-face or perfect profile), and under precisely the same conditions of light and shade, and to send them to a firm provided with proper instrumental appliances to make composites from them. The result is sure to be artistic in expression and flatteringly handsome, and would be very interesting to the members of the family. Young and old, and persons of both sexes, can be combined into one ideal face. I can well imagine a fashion setting in to have these pictures.

Professional skill might be exercised very effectively in retouching composites. It would be easy to obliterate the ghosts of stray features that are always present when the composite is made from only a few portraits, and it would not be difficult to tone down any irregularity in the features themselves, due to some obtrusive peculiarity in one of the components. A higher order of artistic skill might be well bestowed upon the composites that have been made out of a large number of components. Here the irregularities disappear, the features are perfectly regular and idealised, but the result is dim. It is like a pencil drawing where many attempts have been made to obtain the desired effect: such a drawing is smudged and ineffective; but the artist, under its guidance, draws his final work with clear bold touches, and then he rubs out the smudge. On precisely the same principle the faint but beautifully idealised features of these composites are, I believe, capable of forming the basis of a very high order of artistic work.

ON THE 'TREATMENT' OF SILVER RESIDUES.

BY J. SORRENSEN, STATE ARCHITECT, BRUNSWICK.*

There are still many photographers who take very little care to turn to proper account the residues and wash-waters of their studios, and though few will be found who entirely neglect the recovery of the silver from their waste solutions, there are cases where, partly through ignorance, partly from indolence, the silver residues are allowed to pass down the sink. And yet the work of recovering the silver is so simple and easy, that we can only wonder how anyone whose vocation must have made him familiar with chemical manipulations can wish to evade it.

Generally the residue, in the shape of precipitated chloride, is sold to the dealer, and there can be no objection to this method if the precipitate has been separated in a pure state, for the honest dealer can then at once pronounce on its

value. But if, as is so often the case, the precipitate consists of a wet and shiny mass of silver chloride, mixed with the dregs of the developing and fixing solutions, and often containing bits of paper and other offscouring of the laboratory, how is it possible for the dealer to form an idea of the value of the pure silver it contains? The separation of such a mixture costs time and money, and must be taken into account. Cleanliness and care are therefore of the greatest importance in any process for collecting the residues.

For the reduction of the precipitates to metallic silver, the only reliable method is that by fusion. Reduction in the wet way can only be employed in the case of the chloride, and if a special galvanic apparatus is not used, the silver thus obtained is likely to contain impurities, especially zinc; hence it is preferable to resort in every case to fusion. For this process a tolerably large crucible must be used, and the reducing agent must be added in small quantities at intervals, waiting on each occasion until the reaction, which may be recognized by the mass frothing up, is complete. Any ordinary stove in which coke is burnt can be employed for this operation; when it is finished the crucible, after being allowed to grow cold, is broken, and the metallic silver will be found at the bottom in the form of a button.

So far, the manipulation of the silver residues presents no material difficulties, but the subsequent conversion of the metallic silver into the nitrate, especially the operations of evaporating the nitrate solution and the fusion of the resulting salt, are among the most disagreeable proceedings which the photographer has to undertake. The fumes of nitric acid which are given off during the evaporation contain towards the end of the process much nitrate of silver, and, spreading to a great distance, they cover all articles of furniture or other objects in the room with a number of small black spots. When the operator has adopted the bad habit of using his dark room as a laboratory, this visitation may produce incalculable mischief. After all, instead of the accustomed pure white silver nitrate, the operator will perhaps find he has a nasty dark mass, which has an acid reaction, and contains silver nitrite, the source of innumerable failures in the negative process. If, on the other hand, the silver nitrate be allowed to crystallise out without coming to the fusing point, a purer product will be obtained; but for an unpractised chemist it is difficult to free the crystals completely from the mother liquor, much of the silver nitrate remaining in the latter, so that, after all, fusion has to be resorted to. For these reasons it is in every way better for the photographer who is not provided with all the conveniences of a well-furnished chemical laboratory to confine himself to the production of metallic silver, which, as above explained, is not a difficult process; he will get a good price from the dealer, and is quit of the troublesome and noxious operation of reducing the metallic silver to the nitrate.

A point of material importance in this working up of the silver residues is the financial question, inasmuch as the profit is the greater, the greater the quantity of material one has to deal with. Now, in the production of silver nitrate on a large scale, it would be much too costly for the manufacturer to use fine silver only, as well as much too difficult to get this substance in sufficiently large quantities; he is compelled to have recourse to ordinary standard silver containing a certain portion of alloy. For the photographer who has not the necessary convenience and skill, the production of pure silver nitrate from metallic silver alloyed with copper is a work of great difficulty and troublesomeness, and not by any means worth his while. The relation of the price of fine silver to that of the nitrate varies, of course, with the market, but, as a general rule, is in the proportion of 15 to 12; assuming, therefore, that fine silver can be sold at its full value, we ought to get for each part of fine silver one and a quarter parts of nitrate. On the other hand, by the conversion of one part of fine silver we should get 1.57 parts of nitrate, the advantage, therefore, in conversion over the exchange being about one-

* Photographische Mittheilungen.