of colour, and particularly of the absence of necessary touches of complementary colours in the shadows, which they say are of the same colour as the lighter portions. They find no vibration, no life in the colours, though vivid, probably because of the monotony of the colour areas. This unfavourable verdict has been quite unanimous on the part of the painters, as far as I have been able to ascertain."

To the reproach of "untruthfulness" we shall answer that one of the principal grievances stated by the art critics at the Autochrome exhibition was precisely the unerring exactness in the reproducing of the natural colours, exactness preventing any operator's intervention. Allow us to observe that if amongst the hundred proofs exhibited, two or three deserved the artist's favour, it is a sufficient proof that the process is able to give artistic sensations, and if the other ninety-seven did not deserve the same, the fault must be charged to the operators and not to the process: every photographer not being a born colourist.

Moreover, in our annual salons of painting, this 3 per cent. average of really good work is not reached, and certainly it is not in the Parisian club's exhibitions of pictures that we shall find a number of works animated by the sacred artistic inspiration to better the average.

Complementary Colours in Autochromes.

"Painters find that the colours of the Autochrome are without vibration, and that they lack life, though they may be vivid." We would not pretend that a mechanical photographic process could ever equal works produced by human genius, of which we hold a true appreciation following long and intimate association. Nevertheless, having had occasion to examine alternately a series of large and excellent Autochrome transparencies penetrated by the vivifying light of day, and a number of paintings by a good colourist, we felt in regard to the latter a lack of life and depth. If the Autochromes had been simply glaring and vulgar, it would seem that the looking at the harmonious pictures would have been on the contrary a rest to the eye. As to the absence of necessary touches of complementary colours (that so many artists neglect or appear to be unaware of), we have the right to think, in basing our opinion on Chevreul's lessons, that the complementary must exist naturally and necessarily when the primary colour exists, but we can, with the aid of the magnifying glass, prove the real presence in the Autochromes of green complementary elements in the shadows of the reds, and of red complementary elements in the shadows of the greens, and so on, the same for the other colours. *It is to be understood that we speak here of the Autochrome, and not of photochromy in general.*

Because we see every day worthless gum and oil proofs we do not seek for a moment to incriminate the process which has produced admirable works in the hands of artistic operators; for example, M. Demachy. We must treat with the same equity the Autochrome process, which, though recently born, has already produced a great number of good operators.

If the painters consulted by M. Demachy have proved unanimously unfavourable, it would be easy for us, on our side, to indicate by name painters, both of the classic and more advanced schools, who have expressed high appreciation.

The day when M. Demachy, one of the greatest among our amateur photographers, will himself try the process, we do not doubt that his own opinion, which we hold in the highest esteem, will become more favourable to the Autochrome.

ANTONIN PERSONNAZ.

THE CONVERSION OF SILVER IMAGES INTO THOSE OF LEAD AND OTHER METALS AND THE USE OF THE COMPOUNDS AS MORDANTS FOR OBTAINING PRINTS IN DIFFERENT COLOURS.

A paper read before the recent Congress of Applied Chemistry in London.

SOME years ago Dr. A. Traube described and patented a method of subtractive three-colour printing to which he gave the name of "diachrome," and which was based on the fact that an image consisting of iodide of silver was able to attract and retain certain aniline dyes. For example, an ordinary positive transparency or lantern plate, on the conversion of the silver image into silver iodide by means of a solution of iodine in potassium iodide, was found to take up dye on immersion of the bleached plate in a solution of the latter. I do not know if the products necessary for the "diachrome" process are on the market, but I have not yet been able to obtain them.[1] On the other hand the attempts which I have made with a certain number of dyes have given me a negative result. With some dyes it is certainly found that the colours show a greater tendency to attach themselves to the parts of the transparency where there is iodide of silver than to those consisting only of gelatine, but with the successive washings which are necessary in order to obtain pure high-lights the colours almost completely disappear. It would seem that the dyes which possess the property described and applied by Dr. Traube are somewhat rare, and it does not seem easy to obtain them among those colours which are suitable for the making of three-colour transparencies.[2] It has occurred to me that in place of employing an image consisting of a silver compound it would be possible to make use of other compounds capable of playing the part of mordants more readily in the case of many dyes than does iodide of silver. The fixation of the dye would thus be assisted. On this basis I have attempted to replace the silver of the image by lead compounds, and although the results which I have secured are not yet completed they are sufficient to lead one to anticipate that by this process it is easy to obtain images of any colour whatever. Besides lead compounds I have attempted to use also those of copper and of cobalt by employing the known toning methods, such as ferricyanide of copper and ferricyanide of cobalt, but the results have not been very satisfactory in the case of the copper compounds and altogether negative in the case of those of cobalt, and I have therefore thought it best to confine my experiments to the lead compounds, the results of which are far and away the best of the three.

Preparing the Bleached Image.

I should say to begin with that the aniline dyes which are

[1] The materials are supplied by John J. Griffin & Sons, Ltd., Kingsway, London, W.C.—EDS. "B.J."

[2] It should be stated that the dyes supplied by Messrs. Griffin for the diachrome process are intended for the production of warm-toned lantern slides, which purpose we have found, as the result of making a comparatively large number of slides, they fulfil admirably.—EDS. "B.J."

most suitable for this process are the basic colouring matters. The procedure is as follows. The transparency, preferably made on a chloro-bromide plate, is immersed in a bleaching solution prepared as follows :—

A.	Lead acetate	1 oz.	5 gms.
	Acetic acid	1½ drams.	1 cc.
	Water	20 oz.	100 ccs.
B.	Potass ferricyanide	1 oz.	5 gms.
	Water	20 oz.	100 ccs.

Equal parts of A and B are mixed together, and the well washed and fixed print is placed therein until completely bleached. It is then washed for half an hour or more in running water until perfectly free from yellow stain. As the gelatine invariably retains traces of lead oxide I have found that it is necessary to treat the prints for about ten minutes in a 2 to 3 per cent. solution of nitric acid, which is without action on the ferrocyanide of lead but removes the lead oxide only. The rinsed plate is then placed in a 10 per cent. solution of hypo (a stronger bath should not be used) which removes the ferrocyanide of silver but leaves the ferrocyanide of lead. If the plate is kept longer than proper time in the hypo bath a certain reduction takes place. The final result is a beautiful white image consisting of lead ferrocyanide.

A Yellow Image of Lead Chromate.

This image is susceptible of modification in several ways. First by immersing it in a 5 per cent. solution of potass bichromate we obtain in a few moments a complete conversion of the lead ferrocyanide into yellow lead chromate; this image, however, is yellow only by reflected light. Seen by transmitted light it is a yellowish-grey, and it cannot be employed in all cases for the yellow component of a three-colour transparency. On the other hand I have found that it answers perfectly for three-colour prints to be examined by reflected light, and if plate-makers would supply a chloro-bromide emulsion coated upon opal glass it would be easy to obtain excellent three-colour prints by employing the lead chromate as the material for the yellow print.

Opal Glass as a Support.

In order to examine the effect produced I have removed the film from a lead chromate transparency prepared in this way and transferred it to opal glass. On this I have laid down a red film obtained by the usual imbibition process, and on this again a glass transparency toned to a blue by the usual iron ferrocyanide method, this latter transparency being laid face down and thus serving as a cover glass for the three-colour print. An excellent print made by this process was presented to a conference on colour photography held at Milan some time ago.

Lead Sulphate as a Mordant of the Dyes.

Returning to our subject proper it must next be pointed out that the second modification which can be made in the lead ferrocyanide image is the conversion into lead sulphate. For this purpose it is necessary only to immerse the plate for a few minutes in a solution containing sodium sulphate.

Sodium sulphate	1 oz.	5 gms.
Sulphuric acid (by weight)	45 grs.	.5 gm.
Water	20 oz.	100 ccs.

To the sulphate of lead image thus produced, the various dye solutions may be applied. I have not yet been able to try a large number of dyes, but I have obtained satisfactory results with auramine for the yellow, saffranine for the red, and methyl-blue for the blue. These dyes are made up in 1 or 2 per cent. solution, and the plate bearing the lead sulphate image immersed in one or the other. At the end of a few hours an intense image is obtained with also a certain amount of veil due to the presence of the dye in the clear gelatine. Washing the plate removes the dye from the gelatine and leaves it only in the image. In order then to obtain a perfectly transparent image the sulphate of lead is removed. Before doing this the dye is further fixed in the gelatine by means of a 1 per cent. solution of copper sulphate, and the plate then immersed in a concentrated solution of hypo containing 7 per cent. of boric acid. This solution exerts a somewhat slow solvent action upon the lead sulphate, but there is finally obtained an image consisting only of the dye.

Dye-images fixed by Oxide of Lead

This treatment with a saturated solution of hypo exerts a somewhat prejudicial action upon certain dyes, and in some cases leads to a loss of colour to such an extent that an image prepared with certain colours appears too degraded after fixing, but I am continuing my experiments on this part of the process. I have further attempted to employ an image consisting of hydrated oxide of lead in place of the lead sulphate in order to obtain a better fixation of the dyes. In treating the lead ferrocyanide image with a 1 per cent. solution of caustic potash the ferrocyanide is converted into pure white hydrated oxide of lead. After washing the dye can be fixed on this image, employing preferably a solution of the colouring matter made slightly acid with acetic acid. With certain colours this method gives better results, and since the oxide of lead is less opaque than the sulphate there is, as a general rule, no need to remove it from the image.

To sum up, this method, although not completely worked out, would seem capable of supplying the basis for a new process for the making of three-colour prints and transparencies.

R. Namias.

EXPERIMENTS ON THE CORRECT TIME OF EXPOSURE OF AUTOCHROME PLATES.

A Paper read before the Union Nationale des Sociétés Photographiques de France.

The following experiments have been carried out in order to endeavour to obtain a simple basis for exposure of the Autochrome plate. The materials and methods are at the disposal of photographers possessing the most primitive outfit, and it is, therefore, to be hoped that others will repeat and confirm the results which have been obtained. The starting point has been the determination of the ratio between the light received by an object and the light received by the image of the object through a lens working at *f*/10. We first made the following experiment:—A sheet of white Bristol board was illuminated by a candle placed one metre distant. The light falling upon the board was recorded by exposing a Lumière plate (blue label) for one second at one metre distant from the candle. We then photographed the Bristol board with a lens the aperture of which was exactly one-tenth of the conjugate focal length. Three exposures were given, of 800, 1,000, and 1,200 secs., and it was found that the time of a 1,000 secs. was practically comparable with the direct action obtained by exposing the plate directly to the candle for one second. Thus it appears that the quantity of light producing the image of a white object under these circumstances is the thousandth part of the light received by the object. This result was then extended by