selves over a more reputable area, and it began to be seen that for the purposes of ethnography and cognate pursuits, the new departure was a valuable one.

Much ingenuity has been since expended in bringing to perfection the manipulative details of the camera, so as to ensure that, wholly and solely, none but the "points in common" of the conjoined photographs shall come to the surface. The experimentalists have multiplied, and various *bizarre* deviations have been sought out. In the States considerable attention has been given to the matter, and as many as thirty photographs have been posed into a single composite.

But these essays and amplifications have rather interfered than otherwise with certain practical and pressing questions connected with individual development and personal identification. The very rise of composite portraiture seemed at the outset to be a menace to the legitimate legal purpose of the identiscope; and in effect it decidedly interposed itself before the public eye.

By a stroke of fortune, early in the present year, in the *Lancet*, in the *British Medical Journal*, and in *Knowledge*, admission was simultaneously given to an article by the present writer. In this, the vitality and interest of the prior questions were duly maintained. And again, in the month of July, the journals of photography opened their columns to an effort on the part of the writer to track into the very territory of the composites the important speciality of identification. The month of September has seen in the same journal the complete and satisfactory realization of the writer's original aim and purpose—the task of educing from photographic portraiture unimpeachable proof of personal identification; and at the same time of affording irrefutable evidence that the Tichborne Claimant is the true and original Tichborne. Out of the nettle, danger, has been plucked the flower, safety.

INFLUENCE OF LIGHT ON THE COURSE OF THE CHEMICAL REACTION OF CHLORINE, BROMINE, AND IODINE ON AROMATIC SUBSTANCES.

BY DR. J. M. EDER.

More than a year ago, Julian Schramm, in the *Chemiker Zeitung* (1884, p. 1654), wrote upon the action of chlorine, bromine, and iodine, upon benzol and toluol. Benzol appeared to suffer no change, but with toluol a reaction took place in sunlight even in an ice-cold solution.

From a communication that has recently appeared in the *Chemiker Zeitung*, it appears that the aniline colour manufacturers have long made use of the action referred to in this observation. In the manufacture of "malachite green," pure benzalchloride is used, and it was found advantageous to prepare this by the agency of sunlight. The work, however, was dependent upon weather, and the next step was the employment of the electric (arc) light. The operation was carried on in white glass globes, into which tolnol warmed to 50° or 60° Cent., and chlorine, were introduced. Very good results have been obtained, but whether the method is a practical one must be left for time to determine. In any case it is gratifying that the chemical action of light should be brought into actual use in technical chemistry.

RESEARCHES ON THE CHEMICAL ACTION OF LIGHT.

BY PROFESSOR DR. J. M. EDER.*

3.—Various Copper Compounds.

Double oxalate of copper and sodium forms blue crystals of needle-shape, which in darkness remain unchanged for years. In the light after many days it becomes changed upon the surface to a brownish-black colour, but is not altered in weight. The sensitiveness to light is not important.

It appears remarkable that the analogous potassium and ammonium double salts are unchanged by light. I am not aware of any similar example with other compounds. Solution of sodium copper oxalate is also permanent in the light. If, however, the solution contains ferric-oxalate, oxide of copper is deposited after a day's exposure to the sun; later on this is mixed with ferrous-oxalate.

The sensitiveness to light of the so-called Fehling's solution was noticed by Fehling himself in the year 1849.* He wrote: "It is very necessary that sulphate of copper, tartrate of potash, and caustic potash be present in proper proportions. When this is not the case, the solution decomposes quickly in the light, and in the sun's rays immediately.

The solution, however, employed in analytical chemistry as Fehling's solution† is itself sensitive to light.

I have examined the decomposition of solutions of different degrees of concentration after three and a-half months' keeping in light, and in darkness.

Concentrated Fehling's copper solution gives in the light 0·731 grammes of oxide of copper.

Concentrated Fehling's copper solution gives in darkness 0·021 grammes of oxide of copper. Difference = 0·710 grammes.

Fehling's solution diluted with an equal volume of water gives in the light 0·110 grammes of oxide of copper.

Fehling's solution diluted with an equal volume of water gives in darkness 0·003 grammes of oxide of copper. Difference = 0·107 grammes.

Fehling's solution diluted with 6 volumes of water gives in the light 0·040 grammes of oxide of copper.

Fehling's solution diluted with 6 volumes of water gives in darkness no precipitate that can be weighed.

It follows:—1st. That the decomposition of the solution in darkness is much diminished by dilution; 2nd. Under the influence of light there is separated, both in the concentrated solution and in that which is diluted with an equal volume of water, about thirty-five times more oxide of copper than in darkness; 3rd. Highly-diluted solutions are quite permanent in darkness, whilst they are still decomposed to a recognizable extent in light.

4.—Indigo Sulphate of Soda.

Indigo sulphate of soda is in aqueous solution very indifferent to light. Mixed with soda and oxalate of ammonia the solution, after two days' exposure to the sun, becomes slightly bleached. Light acts more quickly upon a mixture of indigo sulphate of soda and grape sugar; nevertheless this is not a pure action of light, for warmth in darkness produces an immediate reduction.

5.—Molybdic Acid.

Molybdic acid dissolved in dilute sulphuric acid, according to Phipson,‡ becomes blue in sunlight, and in darkness again loses this colour. I have previously shown in another place that this bluing only occurs in the presence of organic substances, and that in this case the blueness no longer disappears in darkness. Mixtures with sugar become blue in darkness as well as in the light (formation of oxide of molybdium in consequence of reduction), but in the light more quickly.

6.—Decomposition of Chlorine and Bromine Water and of Tincture of Iodine in Light, and the Influence of Organic Substances upon this Process.

The first labours in this direction that were published were those of Bärwald and Monheim in 1835, and they

* Continued from page 645.

* *Annal. Chem. Pharm.* 1849, B. 72, S. 106.

† 34·639 grammes of sulphate of copper dissolved in 500 cub. cents. of water, 173 grammes of bi-tartrate of potash, and 125 grammes of caustic potash dissolved in 500 cub. cents. of water.

‡ Eder's *Ausfuhrliches Handbuch der Photographie*, 1884, 1 Th., S. 22.