elongated prismatic form, preferably deposit themselves, and finally completely cover them.

We believe that this body is an isomeric modification of aldehyde, known under the name of metaldehyde. For the analogy of the characteristics we have remarked completely confirm this opinion. Thus, the formation of the crystals of metaldehyde is greatly favoured by the asperities of metallic fragments, such as zinc and iron turnings, and heat volatilizes without melting them. But a very remarkable phenomenon, which we have not always succeeded in reproducing, and which shows the identity of these two bodies is, that the vapour arising from the volatization of the crystals which gather together in the air, condense under the form of light, snowy, flakes.

In winter, we sometimes remark, when these collodions are exposed to very severe cold, that there is formed in the centre of the liquid long and thin transparent needles, resembling frozen water. We have found it impossible to isolate this substance from the collodion, as it appears to melt as soon as the liquid is disturbed; and if we happen to succeed in isolating it, it disappears by evaporating immediately it comes into contact with the air. This substance must be elaldehyde, another modification of aldehyde, which is found whenever there is an oxygenation of ethereal substances.

The formation of similar prismatic needles had been previously observed in old collodions, but they were regarded as being nitrate of potassa, produced at the expense of the nitric acid, attributed to the decomposition of the pyroxyline. This mode of regarding it does not explain the properties of the body in question. Besides, we have remarked these crystallizations in collodions which contained no iodide of potassium. Those of iodide of ammonium, zinc, cadmium, iron, and others of organic bases, produce just the same phenomenon.

We conclude by remarking, that it is an error to introduce any metal whatever into collodion, with the view of rendering it colourless, and making it keep longer. In this case, the reactions are hidden from the eye, but they take place just the same, and even more rapidly, as we have already stated.

Besides, it is from want of experience that we believe it so absolutely necessary to have the collodion colourless, in order for the photographic operations to proceed successfully, especially when we make of it a generality which must be extended to all modes of working. In most cases it is, in fact, advantageous that the collodion be not too much coloured by iodine, when the development of the picture is effected by means of a weak reducing agent, such as gallic or pyrogallic acid; but, on the other hand, there is an inconvenience—an obstacle even, when the development is effected by sulphate of iron, a case in which the best specimens are those obtained with a collodion reddened by the addition of a considerable portion of iodide, and a weak and acid sensitizing bath.

There is a very material difference between a collodion reddened by decomposition, and another reddened by the addition of free iodine. In the latter case it loses none of its sensibility when its normal state is that of slowly becoming colourless. Then, whatever be the quantity of iodine added within the limits of $\frac{1}{1000}$ to $\frac{2}{1000}$, it always tends to become colourless when sheltered from the influence of light.

We often make use of collodions to which we add a very strong dose of free iodine, and still obtain as much sensibility as when these products are neutral; but it is then necessary to employ weak and acid nitrate of silver baths, prepared with commercial nitrate of silver, crystallized; while with a neutral and concentrated bath, the obtaining of an animated subject will be impossible, however long the exposure may be prolonged.

Iodine added to collodion does not diminish its sensibility when the silver bath is prepared in accordance with it, but with a neutral or alkaline bath the impression will be extremely slow. The same thing takes place when the collodion is neutral, and the silver bath possesses an acid reaction. But when we employ iodine in the collodion, and the sensitizing bath is feeble, and contain a quantity of free nitric acid, in equivalent proportion to the acid disengaged from the article by the free iodine, we then obtain the maximum of sensibility, with weak and acid products, which offers undoubted advantages.

Free iodine in collodion produces not only nitric acid by its contact with nitrate of silver, but it must be remembered that the alcohol and ether, which also moisten the film at the time of its immersion, tend to complicate the phenomenon by giving rise to nitrous or nitric ether, which the iodine decomposes by oxydizing at the expense of the oxygen of the nitric acid, a part of which is thus transformed into aldehyde and aldehydic acid, ether properly so called, which was united to the compounds of nitrogen.

The elements resulting from this reaction, and which are principally nitrous ether, iodous acid, and hyperiodic acid, act in their turn upon the silver of the nitrate, with which they form special salts, the presence of which very probably modifies the sensibility of the collodion film, to the degree of communicating to it the precious qualities it possesses when there exists in the collodion a quantity of iodine limited to the circumstances.

For collodions reddened by iodine we must employ acid baths; but in place of adding nitric acid to the solution, or of preparing the latter with crystallized nitrate, as is generally done, we infinitely prefer to employ pure fused nitrate of silver, to which, after it is dissolved in water, a certain quantity of alcoholic solution of iodine. To this end we add the iodine solution drop by drop, until the precipitate of iodide remains palpably in excess. The sensitizing bath is in this manner saturated with iodide of silver, at the same time there occurs a formation of special products of a strong and penetrating odour, the presence of which is extremely favourable to the luminous impression.

Among these products we have identified particularly the presence of iodic and hyperiodic acids, which greatly participate in the properties of chloric and hyperchloric acid, and exercise upon the collodion film an action analogous to that of the hyperchlorite of lime upon positive proofs when it is introduced into the toning bath: that is, these acids keep the collodion film clear and clean, without diminishing the sensibility; on the contrary, they seem to augment it considerably, either because of the dilatation they produce in the organic film (pyroxyline), or on account of the salts which these acids form with the silver of the nitrate bath.

(*To be continued.*)

STUDY OF THE WET COLLODION PROCESS.

BY E. REYNAUD.

EXAMINATION OF THE PRINCIPAL CHEMICAL PRODUCTS EMPLOYED IN THIS PROCESS—RESEARCHES INTO THE VARIOUS ACCIDENTS WHICH OCCUR IN PRACTICE, AND UPON THE MEANS EMPLOYED TO PREVENT THEM.

THE wet collodion process is, undoubtedly, the most extensively employed in photography, on account of the many advantages it possesses over most other processes. Still, however, it is not free from defects, and a very brief experience with it is sufficient to convince us that, although it has undoubted advantages, especially as regards rapidity, it is also, like them, liable to many causes of failure.

To study these causes, and to overcome them, has appeared to me a profitable task; and it is in this hope that I have collected and classified the instructions which have furnished me with the method I now practise.

This task will, then, form a methodical and classified picture of the numerous failures which frequently occur to the operator, especially when he first begins the practice of this process, and has not acquired sufficient experience to be able to recognize immediately, by habit, the disturbing causes to which he must attribute the accidents that occur.