

practical service by the shortening of the long exposures necessary with even the most sensitive wet or dry collodion plates. By a still farther large reduction in the time of exposure, much more could no doubt be done. The long hours of patient attendance at the photo-telescope finder could be saved, and plates would be obtained which could at once be transferred to copper to be etched and printed. The new process may also prove useful in spectrum photography.

Prof. Reynolds has found that thio-sinamine and phenyl-thio-carbamide do not form similar compound salts with ammonium bromide; but I have tried some other bromo-compounds of these thio-carbamides, and find that a mixture of bromine and thio-sinamine promises well, and gives rich, vigorous images, with good, clear lights and well detailed shadows. I have prepared it by adding bromine water to a saturated solution of thio-sinamine, about equal parts. After a time the solution turns slightly opalescent and cloudy, probably from the precipitation of sulphur.

Dr. G. McGowan has found that excess of bromine causes thio-carbamide to lose its sulphur, and become converted into carbamide (*Journ. Chem. Soc. Lond.*, 1887).

I have lately been working with a form of developer which seems to act satisfactorily in the reversing process, and is simple:—

Eikonogen ... ..	...	...	5 grains or 1 gramme
Sodium sulphite ... ..	...	5	1
Lithium carbonate ... ..	...	5	1
Water ... ..	...	1 ounce	100 c.c.

The carbonate of lithia is kept in saturated solution at about one per cent., and the other salts are dissolved in it as required. A paper on lithia and borax developers has been long in hand, and should have appeared some time ago, but I hope to give it in an early number of the NEWS.

As both thio-sinamine and thio-carbamide can quite easily be prepared, a few notes on their preparation, from experience, may be useful to anyone wishing to try the method, and unable to obtain them in commerce.

To make Thio-Sinamine.—Procure some essential oil of mustard from the chemists; the pure mustard oil is best, but not easily procurable. The common oil contains resinous impurities which are very hard to separate out without re-distillation, which is a troublesome process, though they do not seem to interfere with the reversals. Care must be taken in handling this oil, because it gives off unpleasant, strong-smelling vapours, which are very irritating to the eyes. Having put some of the oil—say two drachms—into a stoppered bottle, add to it about four to six times its volume of the strongest solution of ammonia—one to one and a-half ounce—and leave it for some hours till the oil has been converted into crystals of thio-sinamine, or taken up as much of the ammonia as it will. The conversion may be hastened by shaking the bottle from time to time; but if the oil is impure, it seems better to allow the ammonia to act quietly, and not take up the impurities. The solution is then poured into an open vessel, in order to allow the ammonia to evaporate. This must be done out of doors, or in an open place, because the smell is very penetrating and unpleasant. The solution may, if necessary, then be filtered and evaporated down, and left to crystallise. Re-crystallisation once or twice will be necessary if the impure oil has been used, and the crystals can be kept or made into solution, as desired. The pure crystals are white and

inodorous. Impure crystals may be yellowish and have a slight smell.

The preparation of thio-carbamide was first described by the discoverer, Prof. J. E. Reynolds, in the *Journal of the Chemical Society of London* for 1869. A quantity of sulphocyanide of ammonium is thoroughly dried till it becomes white and almost powdery. When fairly dry, it may be pounded up and the drying completed. It is then put into a flask, and heated in an oil bath gradually to about 170° C. (338° Fah.), and kept at that temperature for about two hours, the temperature being regulated by a thermometer introduced into the flask. The sulphocyanide melts and gives off vapours, and is gradually transformed into thio-carbamide (sulpho-urea). After sufficient melting, the flask is allowed to cool down to boiling point, and a little hot distilled water (80° C. or 176° F.) introduced; the hot solution is rapidly filtered and allowed to crystallise. The crystals always hold a large quantity of unconverted sulphocyanide, which may be removed by recrystallisation, and, to a great extent, by draining out, especially in damp weather, the thio-carbamide crystals being permanent, while the sulphocyanide is deliquescent. Pure thio-carbamide gives no red colour with a persalt of iron, but it is difficult to get rid of all traces of the sulphocyanide. The crystals take many different forms, partly depending on their purity and other conditions. Sometimes they are in very short, fine needles, at others in long needles, or in long, glistening, fibrous, radiating wisps like asbestos or spun glass, or again in prisms; the latter form seems to be the purest.

Besides the application to astronomical and spectrum photography already noticed, the new process, if it can be successfully worked in ordinary practice, might prove of use for portraiture in the studio, especially in dull weather, or, under other circumstances, when shortening of exposure might be of advantage.

It might also prove of use to itinerant photographers, who could thus be able to take transparent positive portraits which could easily be framed in the style of the six-penny ferrotypes, and delivered, if not on the spot, at any rate in the course of an hour or two, allowing time for washing after fixing. Another application might be to the penny-in-the-slot apparatus, though here, again, time would be required for washing away the fixing agent. For reversed negatives and lantern slides, it may also be found useful, as well as for a great deal of amateur work in which a single positive transparency might really be more useful and better worth keeping than a negative. Its possible adaptation to the new diazotype process has already been suggested in the NEWS, and from rough trials I have made would, I believe, answer well.

Wratten's "ordinary" plates still continue to give me the best results, and the fresher they are the better. There are, no doubt, however, other brands which might work with more certainty. The great difficulty is to get rid of the first developed negative image; and, if obtainable, something is required which will develop up the positive image at once. From some of the results lately obtained with Prof. Reynolds's compound salt, I believe that the process is capable of giving perfect transparencies with suitable plates; but in this country one works under very great disadvantages and limitations caused by want of leisure, unfavourable conditions of climate, and distance from European commercial centres, so I hope that the process may be tried elsewhere with various makes of plates, and the results reported.