which would permit the addition of silver when necessary without rapid decomposition. I have tried the addition of small quantities of glycerine and honey to the developer with varying success. If the bath contain no nitric acid, but a drop or two of acetic acid instead, it will be possible to employ a developer containing honey and glycerine, into which silver can be freely dropped. But at present I have not been able to employ it with uniform success. As, however, experiment in this direction is important, for there is nothing so beautiful as the negative developed completely with iron.

The nearest approach to this desired result is gained by the employment of a re-developer of iron, containing a liberal quantity of citric acid, say iron 5 grains, citric acid 10 grains. This solution, unlike pyrogallic acid, improves with age. Where a new bath is in use, as in instantaneous operations out of doors, and no alcohol is needed in consequence in the developer, the employment of this solution will effect a great saving in water, for no washing will be needed between the two operations. As soon as the image is developed by the ordinary iron solution, the image is washed, *if necessary*, or not, at pleasure, and then a portion of the re-developer is taken, and silver dropped in *ad libitum*. This is poured on and off until the requisite density is obtained. It will be found that the deposit is more delicate than that produced by pyro and silver. The negative is now washed and fixed in the usual way. When taken out in the light the image will be found of silver whiteness, and easy to be seen by reflected light. Indeed, it will be found to possess many advantages over the pyrogallic intensifying solution.

PHOTOGRAPHIC CHEMICALS.

THEIR MANUFACTURE, ADULTERATION, AND ANALYSIS.

Silica—(continued.) The combinations of silica with the alkalies are of the highest importance to all engaged in photography, inasmuch as these bodies enter largely into the composition of glass. The chemistry of the alkaline silicates is most complicated, and would be of very little interest to any of our readers, who would, doubtless, never desire to make their own glass, however perfectly our instructions for that purpose might be given. There is, however, a class of silicates which possesses interest in another direction. We allude to *soluble* glass, which, from its nature, is likely some day to be used extensively in photography. This product was first minutely examined by Fuchs. To obtain a good result, take fifteen parts of powdered quartz and ignite them with ten parts of crude potash and one of charcoal (which decomposes and expels the sulphuric acid contained in the potash), till perfect nitrification takes place. A good red-heat will be required for this purpose. The mixture must be put in a good Hessian crucible, not more than half filled, and the lid placed firmly on. The crucible is then to be put in a wind-furnace, if obtainable, or in a common fire, with a *blower* on, and exposed to a powerful heat from coke, until, on removing the lid, the contents are seen to be perfectly fused. The hard, blistered, greyish-black glass thus obtained is pulverised in a mortar, placed in a flask, and covered with its own weight of water. Heat is applied, and after half an hour, four more times its weight of water are to be added, and the whole boiled together for four or five hours. It will, if the operation has been successfully conducted, almost entirely dissolve in this time, leaving only a residue of impurities, carbonaceous matter, &c. Now filter the solution, and evaporate the clear liquid to a syrupy consistency. By simply drying the solution, the soluble glass is obtained colourless, transparent, and brittle, with a conchoidal, vitreous fracture, but softer than glass. It has a slightly alkaline taste and reaction, and after thorough drying still contains twelve per cent. of water. It is permanent in the air, does not absorb carbonic acid from it, and effloresces only when accidentally mixed with other salts of potash. In the fire it swells up from loss of water, then fuses, and forms an hydrous soluble glass. Dilute acids decompose it, with separation of silica, more easily than concentrated acids. It dissolves very slowly in cold, but readily in boiling, water, when in solution of a syrupy consistency, as obtained by the evaporation of the original liquid, soluble glass forms a tenacious, somewhat turbid, treacly liquid. On boiling or exposure to the air, it becomes covered with a tough skin, which disappears when thrust beneath the surface. After evaporation at a high temperature, it becomes very tenacious, and may be drawn into threads like melted glass. It dries up to a varnish when spread upon wood, &c., and the combustibility of which it diminishes. A dilute solution absorbs carbonic acid from the air—a concentrated one scarcely at all. The stronger acids precipitate silica from the solution, as do also alkaline carbonates, and many ammoniacal salts. Phosphate of alumina, and carbonate, phosphate, or sulphate of lead, when rubbed up with a solution of soluble glass, yield a tenacious mass, which becomes as hard as stone, when exposed to the air. The above properties of solution of soluble glass point out its great value to photographers in many respects. As a varnish it would be perfect, were it not for some little difficulties which are scarcely overcome at present, and which interfere with the uniformity of the film. Several experiments upon the employment of soluble glass are given in detail in our back volumes.

Glass consists of a mixture of silicate of potash or soda, or of both, with one or more silicates insoluble in water, such as silicate of baryta, strontia, lime, magnesia, alumina, manganese, iron, and lead. Pure silicate of potash or soda, or a mixture of the two, even with a sufficient quantity of silica to form a very infusible glass, would still be attacked by water and acids. Silicate of lime is likewise acted on by acids; but a mixture of it with silicate of potash or soda resists their action.

Such mixtures of silicate of soda and potash with silicate of lime, &c., are more fusible than the simple salts, and require a smaller amount of silica to render them capable of resisting the action of water and of acids. They contain between two and three atoms of silica to one atom of base, and still less when alumina is also present. The glass is more infusible and offers greater resistance to the action of water and of acids, the larger the proportion of silica and alumina it contains; it is more easily fused and attacked by water and acids the greater the excess of potash, soda, baryta, lime, magnesia, or oxide of lead which it contains; an excess of the last mentioned oxide renders it particularly fusible, of a high specific gravity, soft, easily scratched, and corroded by acids. Lead glass is also highly refracting, and on this account is of great service in the manufacture of lenses.

When water stands in contact with glass for some time, it extracts potash or soda from it, together with a portion of silica, the decomposition taking place with greater ease in proportion as the glass is richer in these alkalies, and more minutely divided, and the temperature of the water higher. The powder filed from white glass reddens moistened turmeric paper. Water triturated with pounded glass in an agate mortar becomes alkaline, and on the addition of sal ammoniac deposits flakes of silica. Water becomes alkaline after long digestion with glass at a boiling heat, and likewise turbid from separation of an insoluble compound of silicic acid and lime. An alkaline reaction is also exhibited by the powder of bottle-glass. After sufficient washing, it no longer reddens turmeric paper, unless it be recrushed in an agate mortar. These effects are much more striking with some kinds of English glass than with foreign glass, in which potash is generally employed as the alkaline base. It is for this reason, amongst others, that foreign chemical glass apparatus is so highly prized in this country, and Florence flasks are so frequently recommended for experiments in which solution or digestion at a high temperature is to be effected. In common glass, even the