PHOTOGRAPHIC NOTES.

The Hydrochinon Developer.—From a comprehensive history of the hydrochinon developer by Jex Bardwell, in the *Philadelphia Photographer*, we extract the following as an excellent formula:

No. 1.

Soda carbonate	60 grains.
Water	1 oz.

No. 2.

Hydrochinon	2 grains.
Soda sulphite	60 "
Water	1 oz.

For use mix—

No. 1	1 oz.
No. 2	2 "
Water	1 "

The above is a modification of a formula given by C. E. Van Sothern, in which he advises the use of 12 grains of hydrochinon to one ounce of water. It is usually advisable to employ a larger quantity than I have stated when it is found that the gelatine plate used gives a thin image. For line work negatives and transparencies the developer may be used over and over again and then be bottled for use as a starter on another batch of plates. Each successive exposure should be longer when the old developer is used.

Another excellent quality of hydrochinon is the beautiful tone of its deposit, a fine, velvety engraving black, and magnificent clearness in the shadows. I have never used a developer that pleased me better. It has also given me better tones and as pure whites on bromide paper as the regular oxalate developer. I have not tried it on negative paper or films, but I venture to say it will prove just as valuable.

The developer keeps well, the negatives are pure in color, and of any strength that you desire to make them.

It is advisable to develop without the use of bromide. If the plate is overexposed, simply commence with one-half or one-third the stated amount of No. 1. Carbonate of potash answers equally as well as soda.

A Safe Medium for Retouching Unvarnished Negatives.—Karl Klauser, in the *Phil. Photo.*, recommends the following: I produce the desired "matt" surface by crushing and powdering on a glass plate a small lump of resin, and adding to it about a third of its bulk of ashes of cigars or cigarettes. This addition will neutralize the too sticky quality of the resin. Put the mixture in a bag of old, well-washed muslin, daub the part to be retouched with it until a very small quantity of it settles on the negative, and finish by rubbing lightly with your finger over the desired part. A surprisingly small part of this dust will be sufficient to completely deaden the surface and render it fit for the pencil.

Kirchhoff and Spectrum Analysis.

Gustav Robert Kirchhoff, whose brilliant discovery of the significance of the shadows of the spectrum has done more for science than any other discovery of this century, died very suddenly a fortnight ago, although for some years back he has been in delicate health. Professor Kirchhoff was born at Konigsberg in 1824, and had, therefore, only reached his sixty-third year. It is now exactly forty years since he entered the University of Berlin as a *privat docent*, and in 1850 he was called to a chair of physics at Heidelberg, where, in company with Bunsen, he carried on those researches which at last resulted, in 1859, in the discovery which at once raised him to the first rank of natural philosophers, and opened a new era in the history of chemical analysis.

It was in 1814 that Fraunhofer studied and carefully mapped the dark lines in the solar spectrum, which have since been called by his name, and what Kirchhoff did was to show that these lines are a nature-given index—a tabulated and true statement of the constituent elements of the sun. Upon this discovery is founded that system of analysis which has led to the greatest strides in astronomical science since ancient times, and to the most searching analytical process available to the chemist. Before Kirchhoff's time, philosophers had observed that the light emitted by bodies in the incandescent state was capable of some useful application, and it had also been imagined that Fraunhofer's lines bore some relation to the composition of the sun; but the ideas were ill-defined.

It is well-known that sodium salts impart a yellow color to a Bunsen flame, and that potassium gives a violet. A mixture of these compounds gives a yellow color only, that color hiding the potassium flame; but under certain conditions of observation the violet color becomes prominent, and if a ray of light from such a flame be passed through a prism, the yellow and the violet, owing to their different degrees of refraction, are separated. This Kirchhoff observed, and more than this, for he showed that the yellow sodium ray always appeared in the spectrum at one particular spot as a bright yellow band, unalterable in position and intensity, no matter what the conditions of observation might be. So also with potassium and all other elements, each had its particular line or lines on certain parts of the spectrum. The apparatus, which Kirchhoff employed in his investigation is called the spectroscope. It is simply an arrangement whereby a narrow ray of light is thrown on a prism, and the spectrum formed is viewed through a telescope. The best forms of the apparatus are provided with three telescopes, two for forming and conveying the narrow rays of light to the refracting medium, and the third for observing the spectra formed. One of the spectra is the spectrum of pure white light, necessary only for comparison with the spectrum of the substance under examination.

Kirchhoff had not proceeded far with his investigation before he observed that there was a distinct similarity between certain of the dark lines of the solar spectrum and the bright lines of some of the elements; for instance, Fraunhofer's dark line D occupied exactly the same position as the bright yellow line of the sodium spectrum. This led to the supposition that the dark line was in some way connected with sodium; and he found that when he passed a ray of white light through a sodium flame, the bright line of his sodium spectrum had vanished, and was replaced by a dark line exactly like Fraunhofer's line D. Here was an explanation of the dark lines. It was this—that the solar light, in its passage to the earth, traverses a belt of incandescent elements surrounding the sun. Fourteen of the known elements, all metals, were in this way found to be present in the sun's constitution. From these investigations of Kirchhoff's has sprung an entirely new system of observation of the heavenly bodies, which has enabled astronomers not only to prove the constitution of the planets and of stellar and nebulous bodies, but also their position in the cycle of creation and the surface changes which they are continually undergoing. To the chemist the discovery has been no less eventful. It places at his disposal an analytical method which, for delicacy and precision, cannot be surpassed.

The first fruits of spectrum analysis was the discovery of the metals rubidium and cæsium in 1860–61, by Bunsen and Kirchhoff. Crookes followed with the new metal thallium, and indium, with several other elements, have since been added to the number of the elementary constituents of the earth's crust, the latest being germanium, discovered by Dr. Carl Winkler within the past two years. All these we owe to the spectroscope. It is the final court of appeal to which the chemist resorts when there is any doubt about the identity of either a new or an old element. The precision and delicacy of the spectroscope may be judged by the fact that it is capable of detecting about a two hundred millionth part of a grain of a sodium salt. A six millionth part of a grain of a lithium salt may be detected by it, and it is only since Kirchhoff's discovery that it has become known that lithium is a very widely spread element, although existing in such minute quantities as to be unrecognizable by ordinary methods. The possibility of detecting minute quantities of elements in the course of qualitative analysis has had a wonderful influence in remoulding our ideas as to the localization of the elements. There were some which were said not to be found in the animal and vegetable worlds, but the spectroscope has dispelled the illusion.

Mr. John Williams recently remarked that the photographer detects impurities in chemicals long before the physician; but the camera is far behind the spectroscope in exactitude. The latter reveals too plainly that the adage "To the chemist all things are pure" is but a reversion of the true order of things, for it is difficult to get anything so pure that the spectroscope does not discover a foreign element in it. Mr. Crookes' discovery of thallium is not the only service which the spectroscope has enabled him to render to science, his papers on the "Genesis of the Elements," being perhaps the best tributes which the philosopher can offer to Kirchhoff's memory. Yttrium, the element which Mr. Crookes has so long worked upon, does not give a spectrum in the ordinary manner, but when its salts are subjected to the electric spark *in vacuo*, the resulting phosphorescence gives a spectrum which is quite characteristic. Moreover, a solution of an yttrium salt, if placed in the path of a ray of light falling on the spectroscope, creates an absorption or discontinuous spectrum of the element. That is to say, the solution stops all rays of light but those which are characteristic of the element, and these rays appear as bright bands of color against a dark ground. For a number of years Mr. Crookes has subjected yttrium to fractionations, which do not alter its chemical properties, as far as ordinary methods can detect; but in the course of time he has found that the fractionations have visibly altered the absorption spectrum of the element, and he even hopes to show that the half-dozen lines of the spectrum arise from yttrium molecules which differ in some respect from each other. Whether he will succeed in demonstrating this theory or not is hard to say, but undoubtedly his spectrum lines—or, as he calls them, "autograph inscriptions from the molecular world"—have a meaning as significant as the dark lines of Fraunhofer. But the spectroscope has had more humble applications in science.

Some years ago Professor Piazzi Smythe, the Astronomer Royal for Scotland, pointed out that on the approach of rain there appears a characteristic band in the solar spectrum, and this discovery is now utilized in meteorological observations. Even in such a herculean operation as steel making by the Bessemer process the spectroscope has been found to detect the change in the flame which marks the completion of the process. In pharmacy, also, it has its applications. The late Mr. William Southall was the first to notice (1869) that most of the Pharmacopœia preparations gave spectra containing lines peculiar and constant to each. Subsequently Mr. William Gilmour (Edinburgh) took up the subject, and showed that the spectroscope could tell with some degree of accuracy the purity and age of tinctures, as well as their strength in some cases, that other pharmacopœial preparations afforded characteristic and interesting absorption spectra, and that the spectroscope was an excellent means for the detection of admixture and adulteration of vegetable oils. We have by no means touched all the applications of Kirchhoff's discovery; but that a great man has passed away, and that the world is the better for his life, is admitted wherever science has found a footing.—*The Chemist and Druggist.*

The Crowning Achievement of Ophthalmic Surgery of the Present Century.

Under this title Dr. L. Webster Fox describes in the *Medical and Surgical Reporter* Professor Von Hippel's operation for the transplantation of the rabbit's cornea to that of man. By this operation Von Hippel has restored sight to an eye practically blind, and Dr. Fox predicts that it has a brilliant future in doing this kind of work. He saw the patient upon whom the first successful operation was performed, and learned its technique. We cannot do better than furnish to our readers Dr. Fox's very clear and complete description.

The patient operated upon was a young, healthy peasant girl, nineteen years of age, who suffered with a leucoma of the cornea of the right eye, obscuring vision to such an extent that qualitative perception of light only remained. The leucoma simplex obscured the central portion of the pupil, leaving, however, a circle of clear cornea at its outer margin, probably two mm. wide. The instrument devised by Prof. Von Hippel for performing this operation is most ingenious. The trephine is driven by a clockwork and the cylinder is graduated so as to regulate its cutting depth in the cornea. The leucomatous cornea opposite the pupil was removed by this instrument. The eyelids were separated by an ophthalmostat; then, under the influence of cocaine, the trephine was placed on the cornea perpendicular to its plane, the cylinder so graduated as to cut a certain depth, 0·7 to 0·9. This cylinder is then put in motion by a spring clock motion, much after the manner of a Dudgnon's sphygmograph. The hand simply steadies the instrument against the probe. After the circular incision is made comes the most important and delicate part of the operation, *i. e.*, the dissection of the leucomatous tissue from Descemet's membrane. This is done by grasping the inner lip of the incised tissue, and with the greatest care and precision this tissue is removed down to the basement membrane lying in juxtaposition to Descemet's membrane. If, after the removal of this circular piece of cornea, it is found that Descemet's membrane bulges forward through the circular opening, which in almost every case it does, a paracentesis of the anterior chamber is made at the corneo-scleral margin, relieving the intra-ocular pressure.

The rabbit selected from which to obtain the graft is a young, healthy doe. The eye, which is thoroughly cocainized, is drawn forward by an assistant who has inserted under the superior and inferior recti muscles two strabismus hooks. The eyelids are kept open with an ophthalmostat. The drawing forward of the globe enables the trephine to be inserted and watched more accurately in its incision. The cut is made through cornea and *Descemet's membrane.* This graft is then inserted in the incision made in the patient. A fine probe running through the cylinder of the trephine is pushed downward, forcing the graft into place. After the removal of the trephine the upper eyelid, which is drawn forward and downward, is pressed against the inlaid tissue, all being held firm by a pressure bandage, delicately adjusted, the patient, of course, lying on his back. After *three* days the bandage is removed, and the eye examined. If the graft is *in situ*, it will probably be somewhat hazy. If the edges have not turned upward, a successful result may be prognosticated.

Dr. Hippel recently showed a second patient and demonstrated his operation before the Ophthalmological Society of Heidelberg. The patient was found to have a visual acuity of $\frac{20}{200}$, and read Jaeger's No. 6, from which it would be inferred that the new cornea did not clear up completely.—*Med. Record.*

To Color Iron Blue.

One hundred and forty grammes of hyposulphite of soda are dissolved in a liter of water ($4\frac{2}{3}$ ounces to 1 quart); 35 grammes of acetate of lead are dissolved in another liter (one and one-sixth ounce to 1 quart); the two solutions are mixed, are made to boil, and the iron is immersed therein. The metal takes a blue color, such as is obtained by heating it.—*Revue Scientifique.*