

wished to reproduce fifty copies of an astronomical photograph, and, as no daylight was available, performed the printing operations by gaslight—commercial gelatine plates being employed—the exposure, at seven inches distance, about eight seconds, being eight seconds at a distance of seven inches from the flame. In this way we produced fifty pictures in about one hour, and no doubt it could be done in a much shorter time, provided that convenient arrangements were at hand. But although we say one hour, we must confess that fixing was not included. Why is the time required for fixing gelatine plates of commerce so widely different? We have obtained plates which were fixed in five to six minutes, and other plates from the same manufactory needed at least half an hour for perfect fixation. Such plates could be fixed much more rapidly by means of cyanide, but sometimes we lost a plate because the alkaline fixing solution dissolved the gelatinous film.—*Photo. News.*

GOUPIL'S PHOTOGRAVURE.

THE process of photogravure worked out after the Woodbury idea in Goupil's celebrated establishment with admirable success has induced many to offer suggestions as to the best manner of obtaining a grain gelatine relief. Certainly Major Waterhouse's researches, as described in the Photographic Society's Journal, are very valuable, but it is doubtful whether his method is identical with M. Rousselon's. All artists acknowledged M. Goupil's photogravure as the most artistic photo-mechanical process of the day, and, we must add, it is a cheap one. We have purchased a photogravure, after a landscape painting of Lier (size of the picture 24 by 18 inches), for £1, while we have paid more than double the sum for a silver print of the same size. Would it not be possible to obtain the same results, especially with the co-operation of Mr. Woodbury, the original inventor? Indeed, Goupil has spent many thousand pounds in working out the process, and in making it really practical, while perhaps any other person who would wish to do the same would have to expend a like amount. But it seems clear that the result can be obtained by others, as we have before us some pictures of Makart, the celebrated Austrian painter, reproduced by a photo-mechanical process of Mr. Klic, engraved in Vienna. The reproductions are so similar to Goupil's photogravures that they might be confounded with each other. We know that M. Goupil employs the electrolytic method for reproducing his photo-reliefs in copper, and he requires about four weeks for the deposition of the necessary thickness; but Klic, we are informed, only wants three days for making a copper plate from a negative.—*Photo. News.*

PREPARING GELATINE PLATES IN THE STUDIO.

WE have recently had an opportunity of conversing with M. Mottu, of Amsterdam, who is one of the best known continental makers of gelatino-bromide plates, and this gentleman expressed the opinion that, after two or three years, every photographer will prepare his own gelatine plates. We cannot agree with this opinion, as all know how very easy it is to make albumen paper—easier, certainly, than to prepare gelatine plates. Yet only a few photographers, and the owners of very large establishments, make their own albumen paper. How few photographers possess really suitable rooms for the preparation of dry plates? How few can find time for watching over the process, and for making the emulsion? The process may be easily worked out in the winter time, but in hot summer months the whole aspect of affairs changes, and a period of trouble sets in, enough to drive the already over-worked photographer out of his senses. We are informed that last summer almost all of our gelatine plate makers were compelled to work during the night, because the temperature during the day time was so high as to cause constant difficulties to arise. The troubles incident to developing and fixing gelatine plates in hot weather are sufficient to exhaust the patience of the average mortal, but in working with Dr. Vogel's emulsion we are informed that these troubles are eliminated. Until, however, more is known of this preparation, we must withhold our final judgment. Why is it not yet introduced into England? In France it is manufactured by M. Schaffner, of Paris. Our excellent confrère and correspondent refers to the matter in his interesting Paris letter of December 10: "We are surprised to find no one has given an authoritative opinion on the new product." We beg to call attention to the fact that a first rate man like Dr. Eder has given a very favorable report on the subject in the July issue of the *Photographische Correspondenz*. We hope soon to hear more on the matter.—*Photo. News.*

BROMINE IN THE FATTY ACID SERIES.

By CARL HELL and FR. URECH.

THE authors give tables showing the progress of the reaction of bromine with the acetic and propionic acids, normal butyric and isobutyric acids, the valerianic, capronic, and caprylic acids. They recognize three successive stages: that of slow action, from the beginning of the application of heat till ten to twenty per cent. of the molecules of bromine present have entered into reaction, the stage of acceleration, which lasts until about sixty per cent. of the bromine has acted, and the final stage of retardation, which lasts till the process is complete. The effect of the molecular magnitude appears in the first stage. In acetic acid fifteen per cent. of the bromine molecules present are substituted in forty hours; in the next homologous acid this proportion is reached in ten hours, in normal butyric acid in 7, and in isobutyric acid in two.

THE MINERAL CONSTITUENTS OF YEAST.

WHEN yeast is burned a very appreciable residue remains, which amounts to from five to eight per cent. on the weight of the air-dried yeast. This residue or ash consists of mineral constituents, among which the phosphates of potash, lime, and magnesia are the most conspicuous. In the cultivation of yeast, therefore, these salts become a necessity; wort made from good malt contains sufficient, but when glucose or cane sugar enters into the composition of the wort, there is usually a deficiency of phosphates; in such a case, the so-called "yeast-foods" are advantageous, as they supply the mineral constituents which are deficient in the wort. Occasionally brewers and distillers burn some of their waste yeast, and add the ashes to the fermenting wort, and such a proceeding has been found to produce very satisfactory results.

THE ACTION OF LIGHT.

OUR Huddersfield correspondent sends us the following account of a lecture on the Action of Light, delivered before the Dyers' Scientific Society of that town, by their president, Mr. D. Dawson, of Milnsbridge. The lecturer said:

I think it may be of interest to make a few remarks on the action of light on bodies. If the subject were reversed and stated in this manner—the action of bodies upon light—we should be landed upon a subject so full of intricacies and difficulties, that I should be totally unable to explain to you the many phenomena which it would involve. I only just need to mention some of these phenomena to make plain what I mean, viz., transmission of light through transparent substances, reflection from bright surfaces, refraction, decomposition, and polarization of light, which all belong to the province of optics. Now, the action of light upon bodies has quite another meaning. By it we mean its power to aid in the building up or decomposition of matter; in short, its power to act chemically. In the vegetable kingdom we see being built up vegetable forms on a stupendous scale, and this process of construction is in some occult way dependent on solar light and heat, the relative importance of which is not very clear. It is, however, well established that vegetation cannot flourish without light.

Now, what is the general chemical effect in all these natural constructive operations in which light plays an important part? Chemistry demonstrates that it is one of fixation of carbon, hydrogen, and nitrogen chiefly. Compounds of those are taken as the crude building materials, and are broken up in the constructive process, and the elements fixed in the edifice, so to speak, in the form of other compounds of very complex characters. Indeed, so complex are the natural organic compounds, that only in comparatively rare instances has the chemist been able synthetically to construct them, notwithstanding the vast feats of synthesis which have been performed since a more accurate insight into the constitution of bodies has been gained. These crude building materials of nature, viz., carbonic acid, water, and ammonia, require for their breaking up a most stupendous chemical force ere their carbon, hydrogen, and nitrogen are fixed in the plant in the form of other combinations.

To illustrate the force required for this work, which is apparent at once to one acquainted with thermal chemistry, let us take, for example, the most abundant material required in building up all organisms, viz., carbonic acid, and try to form some idea of the force which binds together the two elements in this compound. If we take a great many of the metallic oxides, and submit them to the most violent treatment out of contact with other reagents, such is the tenacity with which the oxygen and metal are held together, that they undergo no change whatever; but if heated in presence of carbonic oxide, then they are robbed of their oxygen easily, the carbon having a still stronger affinity for oxygen than the metals themselves. Most of the metallurgical operations in which metals are extracted from their ores are based upon this strong affinity of carbon for oxygen; and yet strong as this is, it is split up easily under the threefold influence of vitality and light and heat.

During the process of growth of a plant the carbon is fixed in its structure, and part of the oxygen is sent back into the atmosphere. Now, it is strictly according to law that the force absorbed in bringing about chemical changes, whether direct or indirect, the same force will be given off in the contrary process of restoring the matter to its original form. Therefore when we burn organic matter, let us say wood, coal, etc., the heat given off represents exactly that absorbed during its growth, for the matter in combustion is returned to the same state in which it existed when the plant seized it as nourishment. This fact again furnishes an excellent idea of the forces which operate in these natural phenomena.

It has somewhere been stated by a writer that to-day we are running our steam engines with solar light and heat which has been bottled up for us in the earth for millions of years. This is absolutely true. After these few remarks on the action of light in the natural world, which goes on quite independently of man's inventions and operations, and indeed, went on long before man existed, let us consider what little use, as yet, man has made of this subtle yet powerful agent.

The most conspicuous application of light to the purpose of art is in photography. Nothing in the whole range of applications of the natural forces to the purposes of art can excel the results obtained by photography for exquisite accuracy. Let us illustrate this by taking a photograph; and at the same time I will endeavor to explain briefly the process. Here is a solution of gun cotton in ether. This solution is called by photographers collodion. I take one of these plates and pour this solution over it in such a manner that it flows as quickly as possible over the whole surface of the plate, and the excess is allowed to drip off at one corner back into the bottle, during which the plate must be tilted to and fro, so as to avoid the formation of streaks. The production of a uniform film on the plate is a point of great importance. As ether is a substance extremely volatile, it quickly evaporates and leaves the gun cotton as a tough film adhering firmly to the plate. Now, besides gun cotton there is also a small quantity of iodide of potassium dissolved in the collodion, so that this substance will also be left on evaporation of the ether thoroughly incorporated with the film. This being done, the plate is next immersed in a bath of nitrate of silver. The merest tyro in chemistry will now be able to explain what will take place between the iodide of potassium and nitrate of silver. The elements simply transpose themselves so as to form iodide of silver, which remains on the plate, and nitrate of potassium, which washes into the bath. While this plate steeps a few moments in the bath, so as to insure a complete reaction between the substances, we will just focus an object in the camera.

You see here an inverted image of the object on the ground glass. Now I will bring the prepared plate in a dark slide, which is designed to protect it from exposure to light during its passage to and from the camera. I place the slide in the camera, and the plate which it contains is now in the exact place where the image was seen on the ground glass. I now draw out the door, and allow light to fall upon it. A few seconds is sufficient in good light, and the action has now taken place. The parts which have been exposed to light from the object have been affected, while those kept dark remain unaffected. The exposed and unexposed parts have now different chemical properties, as is proved by the treatment which I am about to submit the plate to, which consists in the first place in pouring on it in the dark room a solution of sulphate of iron, when we see in those parts which have been exposed to light a rapid reduction of the silver compound to the metallic state. After washing away

the excess of sulphate of iron, a solution of cyanide of potassium is then poured over the plate, leaving the silver as the paint, so to speak, of the picture. Here is the picture. Although not perfect in a photographic point of view, it has, nevertheless, illustrated my point; that is to say, the action of light on bodies. But, as might be supposed, the action of light is not by any means restricted to silver compounds. Indeed, in the photographic art itself, which at one time knew only of silver compounds as light alterable substances, there has been in recent times other substances introduced in substitution of silver compounds. For instance, in the carbon printing process, whereby enlargements to very large sizes can be obtained, chromic acid is the light alterable substance employed.

Now, as dyers, in whose hands this substance, as bichromate of potassium, is so largely and often found, I deem it well worth your while to pay attention to this peculiar property of chromic acid, as in some cases it may have some bearing upon your art. I will just mention one fact just to show you why I think so. At one time I made many attempts to fix aniline black on cloth, and I succeeded to that extent that I think it might be usefully adopted in cases where the shade would be suitable. My first process was to work the cloth in a somewhat strong bichrome black, acidulated with sulphuric acid. One bright summer's day, some of the cloth which had been chromed as indicated was thrown up out of doors. After a time I found the light had acted upon it powerfully, the exposed parts having darkened considerably.

Now here was an observation which was destined to prove the nature of the change which the chromic had undergone, for my next operation proved that there had been a reduction of the chromic acid, because those parts which the sun's rays had acted upon did not develop the aniline black to the same extent. It is obvious the chromic acid had yielded some of its oxygen.

The photographer and the dyer stand, in respect to the influence of light on their respective arts, in quite dissimilar positions. The photographer makes use of light as a constructive agent; it is his main agent to obtain the results desired. Now the dyer has to consider the action of light in quite a different aspect. Instead of serving him as it does the photographer—as an aid to obtain the results aimed at—he regards light as the great destroyer of his work. Indeed, light in one sense, while being the friend and ally of the photographer, is the great enemy to the colors fixed by the dyer. No less on this account should the dyer make himself acquainted with its power of attacking his work; for it is one of the chief duties of a general to study the forces which can militate against him, in order that he may bring a superior force to successfully combat the enemy. The dyer, then, has to form a proper estimate of the attacking force of light upon his colors. This can only be done by actual experiment, by exposing them under proper conditions. Throughout the whole range of coloring matters used by the dyer we find a very wide series of gradations in respect to resistance of the decomposing action of light; some colors being attacked in a few hours, while others can withstand its action as many years. This is known not only to dyers, but generally, hence we have the common expression—"Don't have that color, because it fades." But since the introduction of such a great variety of new coloring matters into the art, the public will be puzzled in forming a judgment as to the fugitiveness or permanency of certain shades, and they will often be quite wrong in their conclusions; for the same shade will many times vary in regard to fastness, because it is often produced by the use of totally different coloring matters, each having its own specific power to resist the action of light. But the dyer should be so well acquainted with all colors in respect to light resistance, that he may select the most suitable for special purposes. Where it is of the utmost importance that a permanent color should be used, then of course he must have recourse to one of that class, although in other respects it might be disadvantageous. For instance, it might lack the desired brilliancy, facility of fixing itself to the fiber, or be somewhat detrimental to the material.

Although the resource of coloring matters is now so rich, chiefly by the addition of new coloring matters obtained by comparatively recent researches, the dyer is yet compelled in a host of cases to use fugitive colors where more permanent ones would be far better, because the circumstances in the dyeing operations and the properties of the colors are such that there is sometimes but little choice left as to which must be used. Those circumstances have to be met, even if the color selected be somewhat fugitive. For instance: how many colors are all that could be desired as regards woolen dyeing? But when it is a question of bringing cotton up to the same shade in the same fabric, the dyer has to hunt for another color to accomplish the end, and he often fails to find one in which are combined all the properties required for the purpose. Well, then, he has only to do his best, and the public will have to be satisfied with the best attainable.

The requirements of fashion are so great that it is no wonder the dyer still lacks the means of completely meeting them satisfactorily. But perhaps on this very account the art is more interesting, as it furnishes a field for constant experiment with a view to remove ever-recurring difficulties; and, with the aid of the chemist, the dyer has from time to time removed many obstacles which seemed almost insurmountable. Let us hope, then, by perseverance and application he will always be able to cope with them. The technical schools which are springing up around us, combined with more extended scientific knowledge, will give him immense assistance in his attempts to find new applications for coloring matters, or improved methods of using them.

I have now an observation to lay before you which further illustrates the action of light. I have mentioned the alteration of chromic acid in cloth by the influence of the sun's rays. I think I established the fact that the alteration was due to the reduction of chromic acid. Now it occurred to me that if chromic acid is rendered more deoxidizable under the influence of strong sunlight, or, what is the same thing, becomes a more powerful oxidizer, it might be made to act upon matters which are capable by oxidation of developing a coloring matter, at an accelerated rate, with the assistance of solar light. That the rate of action is so accelerated I will show you a plain proof. It is evident that this accelerated action furnishes the elements for taking a photograph. Here are several formed by the fixation of aniline black on paper by the aid of sunlight. I have now only to show you three colors which I have exposed about fourteen days. I have exposed them in a novel manner. I have placed them under a photographic negative. I have selected two of the most fugitive colors, viz., magenta and crysoidine; the other is an azo compound, and far more permanent. You observe the magenta and crysoidine have