Correspondence.

The Light of the Firefly.

To the Editor of the SCIENTIFIC AMERICAN:

The light emitted by the firefly has always been an object of interest by reason of the small amount of energy apparently required to produce it. It has been one of the dreams of the scientific man to rival this light in efficiency, even if no practical use followed. In this connection a short summary of what is known upon the subject may not be out of place.

The first inquiry naturally suggesting itself is as to the character of this light as compared with light from other sources. It has been found that the light of glow-worms contains photographic rays which will pass through aluminum. It has also been found that the rays emitted by fireflies, after filtration through cardboard or through copper plates, will act photographically, and are capable of reflection and probably refraction and polarization. This would indicate the presence of rays belonging to the extreme ultra-violet end of the spectrum, since it is known that these extreme ultra-violet rays have the power of passing through bodies opaque to the longer wave lengths visible to the eye. If this is so, they are probably the same as the invisible rays emitted by uranium and its salts, which have the power of passing through aluminum and cardboard and are capable of reflection, refraction, and polarization. These are known as Becquerel's rays. In short, therefore, we may say that the light of the firefly contains invisible photographic rays from the extreme violet end of the spectrum, in addition to the ordinary light rays.

Turning now to the construction of the light-producing apparatus, it has been found by Max Schultz that this organ in the glow worm consists of a pale, transparent, superficial layer, which gives off the light, and a deep opaque layer, whose function is less obvious. The Italian firefly, in which both male and female are luminous, has been examined by Emery. Here, as in the glow worm, the organ was found to consist of two layers. It has also been found that the ultimate branches of the tracheæ or air tubes are distributed through the photogenic apparatus; nerve fibers are also present. The luminous organ in the firefly is regarded as homologous to the "fat body" often found in insects.

Now directing attention to the cause of the light, we are met by two very significant discoveries, first, that carbonic acid extinguishes the light, and, second, that oxygen intensifies it. These facts, in conjunction with the known distribution of air tubes in the photogenic body, point very strongly to the theory that the light is the result of some form of slow combustion, while the fatty nature of the luminous cells indicates the probability of fat, with some form of free phosphorus, as the active agent.

It may be added that, as regards light-producing animals in general, it has been found in a large number of them that the luminous organs retain their power after death and even after desiccation and subsequent moistening. There would therefore seem no reason to adopt the theory that we have here to deal with any direct transformation of vital into radiant energy. The most probable explanation of the phenomena, at least in the firefly and glow worm, is that it is the result of slow combustion.

And yet, even granting this is the cause of the light, there remains still to be explained why this form of slow combustion produces these extreme ultra-violet rays while other forms of combustion do not. There is some underlying mystery of molecular physics here well worth investigation. C. M. BROOMALL.

Media, Pa.

Avoid Coughing.

A physician who is connected with an institution in which there are many children, says: "There is nothing more irritable to a cough than coughing. For some time I had been so fully assured of this that I determined for one minute at least to lessen the number of coughs heard in a certain ward in a hospital of the institution. By the promise of rewards and punishments I succeeded in inducing them simply to hold their breath when tempted to cough, and in a little while I was myself surprised to see how some of the children entirely recovered from the disease. Constant coughing is precisely like scratching a wound on the outside of the body; so long as it is done, the wound will not heal. Let a person when tempted to cough draw a long breath and hold it until it warms and soothes every air cell, and some benefit will soon be received from this process. The nitrogen which is thus confined acts as an anodyne to the mucous membrane, allaying the desire to cough and giving the throat and lungs a chance to heal."

ACCORDING to Elektrotechnische Rundschau, underground cables sheathed in glass tubes have been tried successfully at Marseilles, France. The insulation is very reliable, and, the glass tubes being air-tight, the cables are thoroughly protected from dampness.

Miscellaneous Notes and Receipts.

Removal of Rust Spots.—To remove rust spots from stuffs the following methods are recommended: 1. Moistening with potassium cyanide. 2. Soaking in solutio sodium pyrophosphate. 3. Moistening with stannic chloride and immediate washing after the disappearance of the spot. 4. The best and cheapest: Take a bright piece of galvanized iron, lay it on a pot with boiling water, put the wet material with the rust spot on top, dab the spot with diluted sulphuric acid and rub out with the finger. The spot will disappear in a few seconds; after that, wash immediately with ordinary water. Instead of sulphuric acid, oxalic or tartaric acid may be employed.—Neueste Erfindungen und Erfahrungen.

To Deodorize Petroleum and Benzine.—To mask the unpleasant odor of petroleum, etc., an addition of 1 per cent of amyl-acetate is recommended. To destroy the nasty smell of benzine, and at the same time render the benzine colorless, Berninger proceeds as follows: To a mixture of ¼ liter of sulphuric acid and 1·75 liters of water add, after cooling, 30 grammes of potassium permanganate, next mix with 4·5 liters of benzine and allow to stand for 24 hours, shaking occasionally. After this period the benzine is lifted off and agitated for several hours with a solution of 7·5 grammes of potassium permanganate and 15 grammes of sodium carbonate in 1 liter of water. The separating benzine is said to be odorless and colorless, without having to be again distilled.—Wiener Drogisten Zeitung.

Artificial Caoutchouc.—An artificial product, which for certain purposes can take the place of India rubber and gutta percha, is obtained by mixing oxidizable vegetable oils (linseed oil, cotton-seed oil, palm oil, etc.) with tar, creosote, or wood vinegar. Melted or pulverized shellac or shellac solution may, besides, be added. Next the mixture is treated with diluted nitric acid and a non-viscid, elastic, tough product is obtained which can be vulcanized.

According to another, somewhat modified process, the mass is exposed to the action of nitric acid for a short time only and then heated on plates. The artificial caoutchouc is used either alone or mixed with natural caoutchouc, and is chiefly employed as an insulating material for electric conduits and for waterproofing fabrics.—Deutsche Malerzeitung.

Transparencies.—As regards the London transparencies, which are exceedingly handsome and very useful for various purposes, the Papier Zeitung gives some interesting information, from which we cull the following technical details:

White paper is coated with a liquid whose chief constituent is Iceland moss strongly boiled down in water to which a slight quantity of previously dissolved gelatine is added. In applying the mass, which should always be kept in a hot condition, attention should be paid to cover the paper uniformly throughout. After it has been dried well, it is smoothed on the coated side and used for a proof. The transparent colors to be used must be ground in stronger varnish than the opaque ones. In order to produce a handsome red, yellow lake and red sienna are used; the tone of the latter is considerably warmer than that of the yellow lake. Where the cost is no consideration, aurosolin may also be employed. For pale red, madder lakes should be employed, but for darker shades, crimson lakes and scarlet cochineal lakes. The vivid geranium lake gives a magnificent shade, which, however, is not at all fast in sunlight. The most translucent blue will always be Berlin blue. For purple, madder purple is the most reliable color, but possesses little gloss. Luminous effects can be obtained with the assistance of aniline colors, but these are only of little permanence in transparencies. Light, transparent green is hardly available. Recourse has to be taken to mixing Berlin blue with yellow lake or red sienna. Green chromic oxide may be used if its sober, cool tone has no disturbing influence. Almost all brown coloring bodies give transparent colors, but the most useful are madder lakes and burnt umber. Gray is produced by mixing purple tone-colors with suitable brown, but a gray color hardly ever occurs in transparent prints. Liquid siccative must always be added to the colors, otherwise the drying will occupy too much time. After the drying, the prints are varnished on both sides. For this purpose a well covering, quickly drying, colorless, not too thick varnish must be used, which is elastic enough not to crack nor to break in bending.

Frequently the varnishing of the placards is done with gelatine. This imparts to the picture an especially handsome, luminous luster. After an equal quantity of alcohol has been added to a readily liquid solution of gelatine, keeping it ready in a zinc vessel, the gelatine solution is poured on the glass plates destined for the transparencies. After a quarter of an hour, take the placard, moisten its back uniformly, and lay it upon the gelatine film, which has meanwhile formed on the glass plate, where it remains two to three days. When it is to be removed from the plate, the edge of the gelatine film protruding over the edge of the placard is lifted up with a dull knife, and it is thus drawn off while a fine, transparent gloss has remained on the placard proper. In order to render the covering waterproof and pliable, it is given a coating of collodion, which does not detract from the transparence. The glass plates and their frames must be cleaned of adhering gelatine particles before renewed use.

Science Notes.

Through the generosity of Mr. Cornelius Vanderbilt, says Science, the New York Botanical Garden is about to undertake a botanical exploration of the island of Porto Rico. The expedition, which is now being organized, will leave for the new colony within a few weeks, and will carry on collecting of museum and herbarium specimens and living plants for at least six months. Inasmuch as very little is yet known concerning the natural flora of the island, it is confidently expected that much of value and interest will be secured, and the collections will furnish the basis of a report on the botany and vegetable productions of our newly acquired territory.

In Austria 5,578 patents were granted in 1897, of which only 1,795 were issued to Austrians, 262 to Hungarians, and 4 to residents of Bosnia and Herzegovina; that is, 2,061 to subjects of the Austro-Hungarian monarchy. The remainder, 3,517, were taken out by foreigners. Of these, Germans were most numerous, viz., 1,804, Americans were second with 462, British subjects third with 408, and French fourth with 365. The greatest number of patents in one class was in carriages and harness, which includes cycles, 536 patents being granted in this class. In electrical apparatus the number of patents was 297, in household articles 268, in manufacture of gas and gas lighting 231. Nine hundred and seven of the entire number, or 16 per cent, were secret patents.—Wiener Gewerbe Zeitung.

There are a great number of curious superstitions as to the time of day when a dying person is most likely to draw his last breath, and the tide, the moon, and the wind have all been supposed to have some share in the matter. According to The British Medical Journal, Raseri, who has analyzed 25,474 cases of death and 36,515 of birth, where the exact time of day was noted, finds that the maximum number of deaths occur in the early afternoon (2 to 7 P. M.) and the minimum in the last hours before midnight, while the maximum number of births occur in the early hours of the morning and the minimum in the early hours of the afternoon. As regards the cause of this, he points out that the honrs of the maximum number of deaths are precisely those when the pulse rate and temperature are at their highest in health, and when there is a febrile exacerbation in illness.

Persons who rely upon domestic filters to purify water for household use will be interested to learn that, on the authority of the State Board of Health of Maryland, such filters may steadily lose efficiency until they become first-rate culture beds for bacteria, says The Sanitarian. An example cited is that in the case of a man in Baltimore who sends the whole water supply of his house through a large filter, and subsequently puts his drinking water through one of the small domestic filters common in the market. A test showed that, on a day when the city taps were running 510 bacteria to the cubic centimeter, the large filter was delivering 9,900 bacteria in the same quantity of water. When the large filter was repacked, only nine bacteria per centimeter got through it, but this same water when passed through the small filter came out with seventy-one bacteria per centimeter. A further example cited is from the office of the Baltimore Health Department, where a filter, supposed to be the best in the market, was in use. The effectiveness of that filter was so shortlived that the precaution was observed of boiling the water after it was filtered.

A report on the "further developing" schools of Saxony has been made to the State Department by Consul Monaghan, of Chemnitz. With a population of 3,783,014, the kingdom has 1,953 of these schools, with 75,358 boys and 1,699 girls in attendance. Besides these there are 39 higher industrial schools, with 10,660 scholars; 112 industrial technical schools, with 10,119 scholars; 44 commercial schools, with 4,781 scholars; 11 agricultural schools, with 691 scholars; 7 schools of all kinds of work for girls, with 1,569 scholars, and 18 technical schools for girls, with 2,445 scholars. Saxony's wonderful wealth, continues Mr. Monaghan, her industrial greatness, and the fact that she sends out to other parts of the world millions of dollars' worth of all kinds of wares, toys, textiles, tools, and machines attests the importance of these schools. To explain just what is meant by the term "further developing," the consul adds that the system of common school education under which boys and girls were given an ordinary training up to their fourteenth year was found inadequate. Compulsory education was established for graduates of the common schools. The hours of attendance are early in the morning or a certain number of afternoons each week. Manufacturers, merchants, etc., are made responsible for the attendance of the boys in their employ, and the latter make a special study of the trade in which they are occupied.