

as follows: In a dark chamber, lighted by a lamp provided with a red glass globe, or by a window glazed with glass of the same color.

The negatives, once taken, may be kept for several months before developing them, by keeping them dry, and not allowing them to be exposed to the light.



FIG. 4.—SPECIMEN OF PHOTOGRAPHIC VIEW TAKEN WITH THE APPARATUS.

Development.—Several negatives, say four, may be developed simultaneously by the following formulas. The inventor of the apparatus very particularly recommends that the negatives, both before and after the operation, shall be very carefully preserved from the access of the least light, otherwise each would become covered with a film, and hidden.

Formula No. 1.

Alcohol, 40° 150 grammes.
Pyrogallie acid..... 30 "

Dissolve about 5 grammes of sugar in as little water as possible, and add to the alcohol.

Formula No. 2.

Water 150 grammes.
Aqua ammoniæ..... 15 "
Chloride of ammonium..... 2 "

To develop the negatives, there is poured into a basin or other appropriate receptacle the following

Developer.

Common water..... 50 grammes.
Formula No. 1..... 3 "
" No. 2..... 3 "

This solution is to be shaken, and the negatives to be immersed in it until the details are lost through transparency, that is to say, until the plate presents a black and almost opaque film. Then the plate is taken from the developing bath and immersed in water for a few seconds, and afterwards fixed by putting it into a bath having the following composition:

Fixing Bath.

Water..... 200 grammes.
Hyposulphite of soda..... 30 "

When the negative is perfectly clear, that is to say, freed from bromide of silver, it is washed repeatedly with water, and allowed to dry perfectly, when it is ready for

Printing on Paper.—To print from the negative, the latter is laid, varnished side downward, on paper sensitized in a 14 per cent. nitrate of silver bath.

Albumenized paper may be found already prepared and sensitized in shops where photographic materials are sold; but, if the amateur wishes to sensitize the paper himself, he may do so by floating it for about three minutes in a bath of

Distilled water..... 100 centigrammes.
Nitrate of silver..... 14 grammes.

This paper, when dried, is cut into pieces the size of the negative, and exposed, beneath the latter, to the light in a printing frame devised for this purpose. When the proof has become blacker than it should appear when finished, it is immersed in a bath of common water, which is changed two or three times. Then it is toned by immersing it in the following

Toning Bath.

In one bottle put
Distilled water..... 1,000 grammes.
Neutral chloride of gold..... 1 "
In another bottle put
Acetate of soda..... 15 "
Phosphate of soda 15 "
Distilled water..... 1,000 "

Into the second bottle, the gold solution is poured drop by drop, the soda solution being strongly shaken after each addition. In twenty-four hours the bath is ready for use. Finally, when the proof has been toned to a dark blue, it is fixed in a bath of hyposulphite of soda of a strength of 12 per cent., in which it is allowed to remain for about 10 to 12 minutes. Afterward it is washed in a large quantity of water for about 6 hours, dried, and mounted on cardboard by means of dextrine paste.

Such is the photographic field glass. With it the traveler may preserve a durable image of his voyages; the artist, often pressed for time, will be enabled to take a faithful view of a landscape or other object; and the officer, on a campaign, will be enabled to obtain an accurate view of the configurations of soil of a military position, etc.

As has been seen, there are scarcely any immediate manipulations to be performed, the few that are being reduced to operating in a bag impermeable to light, in order to substitute a new plate for one that has already been exposed. These plates, being sensitized by gelatino-bromide of silver, are dry, and present none of the inconveniences of plates prepared in the wet way with collodion.

The subsequent manipulations may be deferred till returning home, and may then, if desirable, be intrusted to a professional photographer.

A NEW ANTISEPTIC COMPOUND, AND ITS APPLICATION TO THE PRESERVATION OF FOOD.*

By PROFESSOR F. BARFF, M.A.

FIVE or six years ago, while experimenting on methods for the preservation of food, I adopted a process which depended on the absorption of oxygen by some suitable substance, the food to be preserved being inclosed in hermetically sealed vessels. The substance I employed for this purpose was green vitriol, or protosulphate of iron; this was mixed with lime, or soda-lime, which rapidly decomposed it, setting free the protoxide of iron, and this absorbed all the oxygen in the vessel. Owing to the formation of sulphate of lime, which, when moist, sets in hard masses, the action was not always complete, as some of the protoxide of iron got locked up, and was so removed from the air, to prevent this, I rubbed up with the mixture some cork or oak sawdust to keep the mass porous, this assisted in the absorption of the oxygen, as either of these substances with lime, or better, soda-lime, itself absorbs oxygen; in fact, oak sawdust and soda alone, when moist, will absorb all the oxygen in any vessel containing air. Many experiments were made which proved conclusively that the whole of the oxygen of the air could be absorbed; and several specimens of raw beef were for a long time successfully preserved, but on most occasions when the vessels were opened, the meat, though looking perfectly fresh, had a very unpleasant smell, which rendered it quite unfit for food. After long investigation, the causes of this were discovered; some of the juices of the meat came in contact with the lime or soda employed, and ammonias were formed, which gave rise to these unpleasant odors. The difficulty in overcoming this defect was so great that I at last abandoned the investigation, and turned my thoughts in other directions.

It is well known that boracic acid is an antiseptic, but its very slight solubility in water renders it, by itself, useless as a preservative of meat. About this time a process was submitted to me, in which tartaric acid was used as a solvent for the boracic acid for the purposes of food preservation. I examined and reported favorably on the process. Specimens of meat treated by it were well preserved. For certain purposes of food preservation it had defects, although beasts injected with it were kept in very good preservation; yet, if the meat was soaked in the fluid, the meat was preserved, but in a very short time the fluid decomposed and stank. It was clear, therefore, that this material could not be used where its presence was required in the wet state, in the substances to be preserved, as in milk or cream. My idea was, then, to get something which would preserve the meat, or other food, and would itself not decompose; for, as I shall try to show before I conclude this paper, that however desirable it is to bring from meat-producing countries whole animals, yet there are other and cheaper methods of easing the meat market, in this and other countries, which should not be neglected. My object in this paper is not to say anything against any existing successful methods for bringing meat from abroad, nor do I wish in the least to interfere with them. The frozen meat process has given good results; it is founded in reason, and I wish it all success. But the quantity of food which we require, and the cheapness with which it can be obtained, are subjects which I am sure you will agree with me demand the attention of all scientific persons.

I tried a number of experiments on solvents for boracic acid, but the result of my work was to show me that no mere solvent was the thing wanted; that some substance should be used which formed a definite chemical compound; for, if a definite compound could be found, then the substances used must always be in the same proportion, if properly compounded. Biborate of soda, or borax, is a solvent for boracic acid, but in using it a large quantity of soda is used which has no preservative action in itself, and could be dispensed with, except that it assists in acting as a solvent for boracic acid. Not to trouble you with the results of my abortive experiments, I will mention that glycerine came to my mind as a very likely substance for my purpose. It has great solvent powers, and then, it is a substance in which some of its hydrogen can be replaced by other bodies. The well known explosive nitroglycerine is glycerine in which some of its hydrogen has been replaced by NO₂, the radical of the nitrates. I found that glycerine, when heated, readily dissolved boracic acid, and I tried many experiments with it in the earlier stages of my work, but always there was a sweet taste, which was objectionable for any preservative substance. To be successful it must be free from any taste. Another reason for the use of glycerine was its well known property of arresting the growth of germs. Many experiments have been tried with it, an account of which may be seen in the last supplement of Watts's "Chemical Dictionary" on the subject of ferments. It was at first tried to get substitution products with boracic acid, similar to those obtained with nitric acid, and my friend, Mr. Paul, who has worked with me all through these investigations, is at present engaged on the subject, and with every prospect of success, so that I hope, before long, we shall be able to publish some interesting and satisfactory results. I have lately seen it asserted that boracic acid alone has not the power of preventing decomposition, but only in combination with other substances, and my own experience entirely confirms this statement. I will now proceed briefly to state the result of our experiments in the preparation of this compound for the preservation of food. Fats are composed of two bodies, an organic acid, or organic acids, chemically united with a substance called glyceril, the symbol for which is C₃H₅.

This glyceril acts as a base with which the acid is combined, therefore fats are salts, just as carbonate of soda is a salt, and one part of the salt, viz., the base, can be replaced by another base, and therefore a new salt can be formed. This is what takes place in the manufacture of soap. Soap is a salt in which the organic base of a fat has been replaced by a mineral base, such as soda. If some oil be boiled for a time with litharge, protoxide of lead, and water, the fat is quite decomposed; its organic acid unites with the oxide of lead, forming a lead salt with the organic acid, and the glyceril which is expelled takes up the elements of water, and

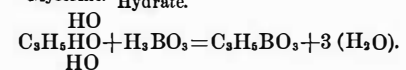
becomes glycerine. Thus: C₃H₅+HO becomes C₃H₅O₃,
HO

glycerine, and this glycerine can be collected and purified. This is one way in which it can be obtained, but when the fatty acids are wanted for special purposes, such as candle-making, and it is not wanted to have them in combination with other bases, glycerine is obtained by acting upon fats with superheated steam, and in this way it is set free, the fatty acids being left alone, the glycerine taking up the elements of water from the steam employed.

The substance which we obtain by the action of boracic

acid, or glycerine, is a body analogous in its composition to fats; it consists of glyceril united with boracic acid instead of with a fatty acid. If 92 grammes of glycerine be mixed with 62 grammes of boracic acid, and if the two be heated together, an action takes place, and steam is given off. In conducting this experiment, it is best to heat the glycerine to a tolerably high temperature, and add the boracic acid in small quantities, continually stirring. The boracic acid dissolves rapidly at first, but toward the end of the operation, it takes a much longer time to dissolve. If the mixture be allowed to cool directly the boracic acid is all melted, a crystalline precipitate will be found to separate out. This precipitate is probably boracic acid, which has only been for the time held in solution, and has not gone into chemical combination with the glyceril. If the mixture be now weighed, it will be found to have lost weight, for it will weigh 131 grammes, whereas at first, when it was mixed, it weighed 154 grammes. If tasted now, it will have a sweet taste of glycerine. After this mixture had been heated a second time, a crystalline precipitate again separated out on cooling, and during the whole heating process, steam was freely given off. When cold, its weight was found to be 116 grammes. Different experiments as to its solubility in water were tried, and as the chemical combination became more perfect, its solubility in water increased. After a third heating, on cooling, no crystalline precipitate separated out, but the mass, when cold, set into a hard mass, like ice; it was somewhat brittle, as ice is, and its surface, when struck with an instrument such as the screw-driver, broke as ice breaks; that is, it was readily chipped, and the small pieces were found to be hard and dry. The weight of the mass was now found to be 100 grammes. 154 grammes had therefore lost 54 grammes, and this exactly corresponds to the weight of three molecules of water, for one molecular H₂O weighs 18. Here is represented, symbolically, what took place:

Glycerine. Boric
HO Hydrate.



Mr. Paul has often and carefully analyzed this ice-like glacial substance, and has found that it quite answers to this formula. It may be well to explain for those who are not well practiced in chemical formula, this equation in words. C₃H₅, glyceril, chemically united with 3(HO) forms C₃H₅O₃, glycerine; H₃BO₃ is the molecule of the hydric borate; B₂O₃ is the molecule of the boracic acid. Under the action of heat, the H₃ from the boracic acid unites with the 3(HO) of the glycerine, forming 3(H₂O), three molecules of water, and the BO₃ of boracic acid takes their place, forming C₃H₅BO₃. For my purpose to-night I think I have gone fully enough into the scientific part of the question. I have already mentioned that my friend, Mr. Paul, is working with me at the subject, and he will prepare a paper which will, I believe, be full of scientific interest.

The demand for food in this and in other densely populated countries is so great, that all methods for importing in a wholesome condition foods from food-producing countries must demand attentive consideration. When I first mentioned this matter to persons who knew the meat trade, the first remark made was, Does it alter the external appearance of the meat? I do not think that this is a matter of vital importance, and for this reason, salting meat alters its appearance, and yet people eat salt meat freely. Salt meat is not imported from distant countries, where it has to travel in hot climates, because so much salt is required to preserve the meat that it interferes with its flavor and nutritive properties; but suppose that meat mildly salted, such as is usually eaten in London, could be brought from Australia or South America, would its appearance interfere, therefore, with its sale? and suppose a very large quantity of the salted meat consumed in London and other large cities in England, and on the Continent, could be obtained at 4d. or 5d. a pound, would it not be a great boon to the people, and also would it not greatly ease the meat market, and tend to reduce the price of fresh meat at home? I make these remarks to prove that there are ways by which we can increase our food supply without bringing our meat to be exhibited in rivalry as to appearance and price with home grown, fed, and killed meat.

Do not understand me to mean that the process which I am describing will not bring meat to the English and other markets in a salable condition and perfectly fresh, having its true flavor; but what I want to-night to show as well is, that other methods can be employed in which a greater general saving can be effected than by the exclusive attention to producing foreign meats in quarters, etc., so as to be placed side by side on the markets with our own meat. I will just take the liberty of laying before you methods in which foods of different kinds may be imported adapted to particular requirements, and then I will conclude with some remarks as to the importation of beasts, whole or in joints. This evening I have on the table specimens of food which have been kept for longer or shorter periods, as they are intended to illustrate various applications of this preserving material. As you know, oysters are imported very largely in tins. They are cooked at a high temperature and hermetically sealed. The high temperature to which they are exposed necessarily causes a loss of flavor, and it is generally remarked that tinned oysters are not a success. This remark, however, requires some qualification, for the oysters tinned and supplied by some of the English firms are really very good, though not to be compared in any way to those freshly opened. I have eaten oysters tinned by Messrs. Crosse & Blackwell, when used for sauce or patties, so good that one had to think twice whether they were not fresh oysters. I have oysters on the table which were opened on the 3d December in last year. I will ask you to taste them, and see in what condition they are, and I would also remind you that they have not been kept in hermetically sealed tins, but simply in corked or stoppered bottles; hence this method of preserving oysters is cheaper than the other, and I maintain that it is more effective, because their natural and fresh flavor is preserved. I am informed by a friend in Jamaica that he has sent me some Jamaica oysters and other things—I trust they will be here in time for me to submit them to you this evening.

Another substance, the perfect preservation of which is very important, is cream, both for home use and for exportation. Cream in London costs from four shillings to five shillings per quart; it can be bought in country places for two shillings, and even for less. This preservative substance will keep cream for months perfectly good and sweet, having its full flavor; so that it would be quite possible to send it in quantities from the country, and its sale need not be pressed as it need not be used immediately. I have regularly every week, except during the holidays, brought with me from Beaumont College, near Windsor, where I lecture

* Lately read before the Society of Arts, London.

a quart of cream treated with one ounce of the boroglyceride; it has always kept perfectly good even in the hottest weather. I have done this for a year and a half; a near relative has taken the greater part of this regularly for the time stated, and this proves conclusively that there is nothing at all injurious to health in the compound. I see a gentleman here present to-night who is connected with that college as a professor of natural science, and he will, in the discussion, be able to give you very valuable information as to the material and as to its perfect wholesomeness. Last month I sent some cream to the Rev. J. Ryan, a Jesuit priest in Jamaica, and I have received a letter from him, from which I will read you an extract:

"26 NORTH STREET, KINGSTON, JAMAICA,
"February 24, 1882.

"The cream which you sent was used by eight of us in coffee, and was pronounced to be wonderfully good. Next morning it was taken in preference to a beaten egg, by the captain of H. M. S. Tenedos, to his coffee."

Last year I sent some Devonshire clotted cream, which I prepared myself, to Zanzibar, on the east coast of Africa. The climate here is very hot; fresh food will only keep a few hours. This cream had to pass through the hot climate of the Red Sea. I will read an extract from a letter written by a lady who received the cream:

"UNIVERSITIES' MISSION TO CENTRAL AFRICA,
"MBWENI, ZANZIBAR, March 8, 1881.

"The Devonshire cream you sent us was quite a success. I received it last night. Fortunately the Bishop and Miss A. — came to Mbweni to-day, so we had it for dinner. That I might have everything correct, I opened a pot of raspberry jam which we had from London a long time ago. The Bishop said it had kept perfectly, but had not quite the rich flavor that it has when quite fresh; he has been used to it in Devonshire. Every one pronounced it most excellent. We sent some in to Mrs. H. —, and were surprised at her sending for more, for she seldom eats half anything we send her. She did not know what it was, but she said she had never had anything here she enjoyed so much."

A year ago I sent some cream from Beaumont College dairy to the Rev. Thomas Porter, the head of the Jesuit Mission in the West Indies. He states that the cream was as good as any he had eaten at home, that he gave it to several strangers to eat, and that they would not believe that it came from England. These experiments and these testimonies prove conclusively that this compound will preserve cream. I shall this evening show you specimens. It is easy to send cream in good condition to the tropics. A great objection to condensed milk is that it is always too sweet. The boroglyceride will preserve condensed milk, and will give it no flavor at all. My friend, the Rev. Thomas Porter, sent me some articles preserved with the material, which I sent him from England; they arrived about June in last year. Some raw, fresh turtle came quite fresh. It was cooked and eaten by several persons, who said it was quite fresh and good, and had the flavor of fresh turtle. At my own house I had turtle cutlets fried; they were perfectly good, and tasted like turtle. Another article which Father Porter sent me was an uncooked Jamaica pigeon; it was roasted at Beaumont College. I divided it and brought half of it home; it was tasted by twelve people, who all pronounced that it was perfectly good, and had the true pigeon flavor. In the same parcel came some green sugar-cane, fresh tamarinds, taken direct from the tree, fresh limes, and the juices of two different fruits—all were fresh, and were tasted by gentlemen who had lived in Jamaica, who all declared that they had all their own peculiar flavors. On the 3d of September, 1881, another box was sent me from Jamaica, containing sugar-cane, guavas, fresh ginger, and turtle; the turtle had come to grief, because it was not properly treated on the other side; the cane, guavas, and fresh ginger have been tasted by those who have lived in Jamaica, and have been pronounced to have their true flavors.

Ordinary milk cannot be kept good for a long time, especially in hot weather. If milk were concentrated in this country, and heated with the boroglyceride, carriage would be saved, and the milk might be kept good and fresh for a fortnight and more; all it would require would be to reduce it again to its original strength. If fresh milk be treated with this preservative it can be set for cream for several days, even in hot weather. The cream which rises will keep, and the skim milk will remain sweet for several weeks; this I have tried in the dairy at Beaumont College. From the cream so prepared butter was made, and was kept for several weeks without a particle of salt, and was eaten by members of the college. I also wish to show another method by which meat can be preserved and cheaply transported. In South America, about Buenos Ayres and the River Plate, many cattle are killed simply for the hides and fat; the flesh is thrown away. Now, if this flesh were cut up in small pieces, and put into the preserving liquid for a night, it would, even in that hot climate, keep good for some time. It could then in a few hours be dried in the sun, packed in casks, and sent to this or to other countries. I have a specimen of beef treated in this way. It was put into the solution on January 19, 1882, dried February 1, and has lately, within a few days, been boiled, and here is the resulting beef tea, which has not in any way been flavored. I have also small quantities of beef juice here preserved in bottles. The juice was expressed, and has been kept raw. Raw beef and mutton juice is recommended by medical men in many conditions of the digestive system. I administered it to a near relation for six weeks, and the juice was preserved good by my material; in the case referred to the effect was very satisfactory. It appears to me to be a most important matter that soup meat, and meat for potting and stewing, should be sent to this country in the way I propose. The supply would be large, the prices low, and the profits highly satisfactory, and it would greatly relieve the meat market, because a very large quantity of fresh meat, which is now used for soup, could be employed in other ways. It has been remarked to me: "But would you get people to use it?" I think, to begin with, that if proprietors of hotels and heads of large public institutions, workhouses, and hospitals, could be shown that for half the cost they could have equally good soup and soup stock, they would willingly use it, and from thence it would come into private use. I have specimens to show the effect of boroglyceride on fish. Here are sprats which have been kept for a year; they are dry, but perfectly good and eatable; also some preserved fresh since January 13, 1882. You will be able to judge of their appearance and flavor. I have also herrings and a piece of skate, which have been preserved for the same time. If fishmongers had a tank of this solution, they could, at the end of the day, put their fish in it, and take it out when required. Bloaters, when lightly cured in hot weather, do not

keep good many days; if a small quantity of this stuff was used with the salt, they would keep good for months. The same may be said of smoked salmon. That which is very salt costs 9d. per lb., but the mild cured kinds cost 3s. 6d. to 4s. per lb. All could be mildly cured if this material was used with the other curing substances. As an adjunct in curing mild hams and bacon, it would be of great use, for these, when cured lightly, would not go bad, as they often do in the summer time. What I have said as to the temporary preservation of fish by fishmongers applies equally to the preservation of meat and fowls by butchers and poultry-terers.

It is justly complained of, that the Australian cooked meat is over-cooked. If it were for a short time dropped in this preservative solution, it would keep perfectly well after being lightly cooked, even under-done. I have a piece of beef which was dipped on the 28th February, and boiled on March 9; it has been left in its own liquid, it was not flavored, and no salt was added. Here, too, is a vast field for the application of the process. Here is also lobster, which was taken out of the shell February 1, and here are two lobsters in their shell, which were immersed on the same day.

I now wish to draw your attention to a parcel from Jamaica, which has just arrived, and from which I am able, I am happy to say, to show you specimens which must be of interest. In a jar on the table is some fresh turtle, which I had simply cooked. I thought it better so to present it to you rather than raw. There is also a Jamaica pigeon, also just cooked here, and a *vol au vent*, which I have had made from oysters, which were sent open in the preserving stuff from Jamaica. These specimens will prove conclusively that food sent from a tropical climate retains its freshness and delicate flavor. I have reserved one of the pigeons raw, that you may see in what state it arrived. Some mutton was shipped to me from the Falkland Islands, at the beginning of last August; a piece of it is uncooked on the table. I have also had a piece stewed, which you will be able to taste; this has, of course, passed the tropics. Through the kindness of my friend, Mr. Haffenden, of the "Andaluzia," in the Strand, who owns vineyards in the southwest of Spain, I can show you some perfectly fresh sardines, which he had placed in the preserving fluid several months ago in Spain, and which he brought with him. You will yourselves judge of their condition; I will only remark that they have the peculiar fragrance of that delicate fish, and will it not be a boon to have a supply of this fresh delicacy at a moderate cost?

You will also see, and I hope taste, a pigeon pie. The pigeons and the steak have been preserved raw in stoppered bottles since the 21st of last November, and the egg since the 4th of July, 1881. I will also call your attention to a tongue, which I myself placed in the solution, February 9, in this year, with some garlic, sugar, and juniper berries, my object being to show that salt can, if desired, be dispensed with. You will, doubtless, find that it will require salt; but you will readily infer that hams, tongues, etc., can be made just as salt as one pleases, and will yet keep perfectly sweet, in fact sounder, than those cured only with salt. This tongue was boiled out of pickle. I exhibit two shoulders of mutton, one cooked, the other raw; they are from sheep killed January 10, 1882. Also a piece of beef preserved on the same day; this, when you have inspected it, shall be cut in slices and broiled. You will see some sausages, both cooked and uncooked; they were made for me by Mr. Bowron, poultryer, of Paddington, early in July last, before I went to Carlsbad. I took some with me to that place, and they were there eaten and pronounced good. These are some of the same lot; they were made as follows: The meat was chopped, put into the preserving fluid for one night, and then mixed with the other material in the ordinary way. They have been kept since in an earthenware jar; they have, therefore, been made more than nine months. I may remark that the bread in these sausages was not treated, and, therefore, it has become slightly sour, but the pork has kept perfectly fresh. I have also some other sausages, which I bought January 12, and at once preserved; these having been steeped, the bread has not turned in the slightest degree sour.

Mock turtle soup, bought ready made from a confectioner's shop in Oxford Street, January 25, treated with the preservative stuff, has remained quite good, and unchanged in flavor.

There is also a specimen of gravy soup made in October last, and some vermicelli soup made about three weeks ago. The preservative action of the boroglyceride in cooked foods is, it seems to me, of great importance to hotel keepers, confectioners, and restaurant proprietors, as it will enable them to buy large stocks when certain articles are cheap, and from the specimen I show of cooked beef, you see it remains quite moist, as it can be kept, without getting sour, in its own gravy and under a layer of its own solid fat. To prove that articles can be kept and dried without losing their flavor, I had some partridges treated and dried last February twelvemonth, and I exhibit some soup made from two of these birds. The other articles on the table are, one raw and one roast fowl, bought January 17; one raw and one roast pheasant, bought February 5; one rabbit boiled, bought January 17. There are also from Jamaica, a green lime, some fresh tamarinds, and some pieces of fresh ginger.

You will notice on the table frying-pans, etc., and some of you will, doubtless, remember the time when I had the honor in this room of introducing to your notice a process for the prevention of rust on iron. I had intended using them this evening, and for the nonce turning cook before you, but Mr. Wood kindly suggested that the housekeeper should do the cooking below, so as to save you from the unpleasant smell of mixed odors. These cooking utensils have been all treated by what is now called the Bower-Barff process, and as you will pardon a little vanity in me, I feel sure I may sing the praises of my child, now that in abler hands than mine, he has been reared and rendered fit for introduction to the public. I have used such cooking vessels ever since I read my paper; they are better and far cheaper than those made of copper. White sugar can be boiled in them for preserving crystallized fruits without the slightest discoloration.

But before concluding, I wish to state that I have made experiments on the effect of the boroglyceride on fermentation, but they are not yet brought to a complete issue. When added to a fermentative mixture, it prevents fermentation, when added after fermentation has begun, it does not stop it, it only moderates it. A gentleman, Mr. McNisch, of St. Neot's, Hunts, largely engaged in the export beer trade, tells me it so far does not interfere with the condition of bottled beer; he requires a longer time to test its preservative powers. A year ago, my friend, the Rev. Mr. Dobson, tried experiments with beer; he will tell you the results of them. As to cost, I can assert that it will not materially affect the

price of the articles preserved. I thank you, ladies and gentlemen, for the patient hearing you have given me.

DISCUSSION.

The Chairman said the paper was marked by the clear and philosophic way in which the subject was treated, and before inviting discussion upon it, he would mention shortly his own experience of the process, the only interest of which was that it was quite independent of Professor Barff. When he was asked to take the chair, he communicated with Mr. Barff, and inquired what the process was. Mr. Barff kindly sent him a specimen of this substance, which he melted, and put some of it into one half of a pint of cream. The other half very soon turned sour, and had to be thrown away, but that to which the substance was added was perfectly fresh that morning. He was confirmed in the opinion of its freshness by the cook, though she said there was a very slight tartness perceptible, by which she could distinguish it from fresh cream. He had also tried another experiment on meat which was chopped very fine, and divided into two parts; to one part he added merely tepid water, to the other, tepid water to which one-sixteenth of its bulk of this compound had been added. This was left on the meat for 18 hours, and then filtered off through muslin. Several days ago the portion which had no preservative was very offensive, but the other portion was that morning perfectly free from any odor whatever.

The Rev. J. L. Dobson said he had had the pleasure of being associated with Mr. Barff in most of the experiments he had detailed, and might therefore anticipate his reply to one or two points raised by Dr. Graham. An experiment which was tried for some time in a large school would answer the question of wholesomeness. At the Beaumont College, Windsor, there was a large staff of teachers, and over 200 pupils, and during the hot weather of last summer the dairymaid was very much annoyed at the milk turning sour, and applied to him to see if he could do anything to counteract it. He handed her some 14 or 15 lb. of this material, and during the whole of the hot weather, and well on into September, it was constantly used, and the milk was preserved; but the method was not detected by any one, either by the younger members, or by those who might be expected to be more critical. No ill effects were observed by the medical officer, or by individuals. From his own experience, he thought the aroma was very well preserved throughout. For instance, in oysters which had been preserved over three months, there was the characteristic aroma of the fresh oyster; mutton could be easily distinguished from beef, and the peculiar smell of the turtle was also very distinct. They had not yet tried beer with so much fullness as other articles, but about nine months ago, a small quantity was treated, and left exposed to the air, with only a loose stopper of cotton wool. It did not grow cloudy in the ordinary way, but owing to the severity of the experiment, and perhaps to not sufficiently treating it, after four months it lost all flavor, became extremely flat, and a slight fungus appeared.

Dr. Thudichum had listened with great pleasure to the paper, and had no doubt if the application of the invention could be effected on a large scale, it would be very useful. He had some experience with regard to a portion of the ingredients used, viz., boracic acid, though he had none of this beautiful new compound. It might not be known to the meeting that boracic acid had been used for a great many years for preserving food, and in fact many of them in summer time had their milk well dosed with it. It had been sold to milkmen in London for years under the name of "aseptin." He had tested it in 1865, and found a great many of those effects which Mr. Barff described. For instance, eggs were beautifully preserved, and steak immersed in the solution did not become either mouldy or rotten, but on the contrary appeared to retain its flavor. A variety of other things, such as cheese and cream, were, either for a long time or for ever, preserved by this application of aseptin. He hoped the addition of the glycerine would increase the power, and prevent some drawbacks which would otherwise stand in the way of boracic acid alone as a preservative of raw or cooked meat.

Mr. Liggins said it was his duty, for many years of his life, to see that the ships of his father and himself were properly victualled for voyages of from three to five months, and he had, therefore, some experience in meat. In his opinion the viands before them, both cooked and uncooked, were in an admirable state as far as the eye could judge. From the description given, he should think any one could use this process without any scientific apparatus, and, therefore, it was a matter of general utility. He had often, when in the West Indies, enjoyed the preserved products of this country and the United States, and had eaten many good joints of meat which had been six weeks at sea; they were preserved in ice—not frozen—and retained their flavor very well. He was not surprised, therefore, at another process, which was capable of bringing things from Jamaica, particularly the fruits. He did not see why there should be any comparison drawn between salt meat and this, though his experience did not quite agree with Alderman Selwyn's; he believed sailors in the merchant navy would be very much offended if their salt meat were withdrawn. He was aware, from reading Cook's and Anson's voyages, that scurvy was once the great scourge of the merchant navy, but there were reasons for that which no longer existed; the voyages were not so long, medical science had very much advanced, and matters of diet were much better understood. He had seen many a turtle killed in the West India islands, and it had to be cooked within an hour. It would be a great saving if what was not immediately required could be preserved for future use, instead of being thrown away. The same with meat; it was the custom there, before an ox was killed, to arrange who should take the different joints, but if those not required immediately could be preserved, it would be a great saving to housekeepers and a convenience as well.

Professor Barff, in reply to the various questions which had been asked, said he had used salicylic acid, and had found it useful in preserving food, but for several reasons discontinued further investigations, one being on the score of its wholesomeness, and he found that his views on that point had been borne out by the action taken by the French Government. Dr. Graham had asked him about flavor; he had given Dr. Graham, a few days ago, some specimens of preserved fish, which he said had lost their flavor, but that would not be found to be the case with the box of sardines. The herrings had been kept in an open vessel, exposed to the air, ever since the day they were put into the liquid, and, therefore, it was not surprising that they had lost their flavor. If they would try any of the things which had been tinned, not soldered up, but such as the Jamaica pigeons, which were in a common corked bottle, it would be found that the aroma and flavor were retained. The only thing

requisite was to keep the vessel so as to exclude the air, as you would with tea or coffee. Dr. Thudichum made some very interesting remarks which there was not time to refer to at length, if he were competent to do so, but not being a medical man, he could not enter into medical questions. As to the wholesomeness of the compound, however, he might say that he had taken large quantities of it himself, and it had never done him any harm; and a near relative had taken an ounce per week regularly for a year and a half, without any ill effect—a person, too, not very strong or of good digestive powers. The boys and teachers of Beaumont College drank milk preserved with it without distinguishing the taste or suffering any ill effects. He knew there were medical opinions in favor of boracic acid, and one physician he was acquainted with used it as a medicine. If it were at all unwholesome, he certainly should not recommend it, but he did not think there was the slightest fear. As to boron getting into the system, it was not boron which was used, but oxide of boron; but even if it did, and he should not be surprised if traces of boron were found in the excreta, it did not follow that any harm was done. There were many things which went through the system without injury; for instance, silica, of which most people took a great deal in the twenty-four hours. As to the cost of the process, the cost per gallon, as far as he could tell—he could not say exactly—would be under 1s.—perhaps 8d. or 9d.—and a gallon would affect an enormous quantity. Most of the articles on the table were put into one pan of solution and the cost of the whole stuff was about 9½d. Should the process be adopted commercially, experiments as to the cost would be most carefully made, and the results published. A joint of any size could be soaked; the only thing was to give it plenty of time. You might soak a piece of beef of twenty pounds, forty pounds, or fifty pounds; or you might use an injecting syringe, such as butchers employed for salting meat quickly, and the meat so treated would keep for a week or a fortnight perfectly good, but he did not think it would keep well enough to pass under a tropical sun. In order to do that you must inject by the aorta, by means of a force pump, so as to send the liquid into all the interstices of the flesh. As to the proportions, one in twenty was the strongest he used, and one in sixty the weakest; for preserving meat, one in fifty answered perfectly well—one pound of the compound added to fifty pounds of water. The bottle should be put before the fire until melted, and then poured into hot water, and it would dissolve. With regard to preserving morbid specimens, he thought it would answer perfectly well. He had had some practice in morbid anatomy, and he might say that, for the injection of bodies to be used for anatomical purposes, it would keep them perfectly sweet. It should be injected by the aorta in the usual way before injecting with the red wax. In reply to Mr. Dipnall he would say that compound penetrated right through into the innermost parts of the meat. If you had an earthen pan and put into it one pound of this and fifty pounds of water, and placed in it a joint which came home on the Saturday night in hot weather, you could take it out the next day and it would keep perfectly for a fortnight. Of course it took time to penetrate into the meat, but the first superficial penetration stopped the injurious effects of germs which set up putrefaction. Another important fact was this: if you had a roast leg of lamb, perfectly good, but did not eat it all, and put it away in hot weather, it would turn sour, but if it had been treated in this way it would not; it would keep for six months without going sour. By adding a small quantity from time to time, which you could only learn by experience, the bath would keep perfectly fresh and effective, though it would be found after a time to get rather dark colored. That arose from the juice of meat, and the advantage of this process was that you need not throw it away, as you must brine, but could boil it down into very good soup. In conclusion, he would only ask his hearers to read the paper and discussion carefully when published, and he was sure any one would be able to carry out the process.

The Chairman, in proposing a hearty vote of thanks to Professor Barff, said the process he had described was remarkable for its great simplicity, and the ease with which it could be carried out. Any cook could readily apply it. The vote of thanks was carried unanimously.

SULPHUR IN PYRITES.

By F. BOECKMANN.

THE methods of Lunge and Fresenius have afforded a satisfactorily accurate and expeditious means of determining the sulphur in pyrites. As a third process, which also gives good results, I recommend the following modification of the potassium chlorate method: Half a gram. of finely ground pyrites (sifting is not absolutely necessary) are mixed in a large platinum capsule with the well-known mixture of six parts sodium carbonate, and one part potassium chlorate. The mixing is effected with a platinum spatula, and is then made more complete by gentle rubbing with an agate pestle fixed to a wooden handle. The whole is then fused over the blast-lamp. The aqueous solution of the melt is first poured into a beaker to avoid spitting, and thence into another tall beaker containing an excess of hydrochloric acid. The filtered solution is heated and precipitated with hot barium chloride, heated gently upon the sand-bath for a time until the liquid standing above the precipitate has become clear, and is filtered at once. The burnt ores in sulphuric acid works have been for a long time assayed for sulphur by this process. I take about two grms. of burnt ore to from 20 to 25 grms. of chlorate mixture.—*Zeitschrift für Analyt. Chemie.*

NEW METHOD FOR DETERMINING THE GYPSUM CONTAINED IN WINES.

By M. E. HOUDARD.

I SUBMIT to the Chemical Society of Paris a method which has rendered me substantial services for more than a year, for determining, in a quick and easy manner and with a sufficient approximation, the proportion of potassium sulphate, or rather the corresponding quantity of sulphuric acid, found in almost all Mediterranean wines from the "plastering" carried on by the growers.

This method does not offer much interest from a scientific point of view, but it may prove important for all those who are concerned with the analysis of wines of ordinary consumption. It is based upon the formulæ of M. Poggiale, modified in 1876 by M. Marty, Professor at Val de Grace, but in place of indicating merely if a wine contains more or less than two grms. potassium sulphate per liter, it enables us to determine the proportion to about one-half a gram. per liter; its chief merit is that, unlike the methods at present employed in laboratories, it is within the reach of all.

The process requires ten test-tubes placed in two parallel

rows, five in each row; a pipette of 25 c. c., graduated in five divisions, each of 5 c. c.; a burette graduated in five divisions, from 0.5 to 2.5 c. c., each division consequently containing 0.5 c. c.

It being known that 10 c. c. of M. Marty's standard liquid precipitates 0.1 gram. potassium sulphate per liter, we begin by pouring into each of the test tubes of the first row 5 c. c. of the wine in question. We then add to each of these tubes, by means of the burette, Marty's standard liquid, pouring into the first tube 0.5 c. c., into the second 1.0, and so on till the fifth tube receives 2.5 c. c. The contents of the five tubes are heated and filtered respectively into the five tubes of the second rank. It is then merely needful to add a drop of the standard liquid to each of the second set of tubes, and to note in which tube it produces a faint turbidity. If, e. g., this turbidity appears in No. 2, and not in No. 3, it appears that the wine contains more than two grms. per liter of potassium sulphate, and less than three grms. Hence it may be concluded that the proportion is about 2.5 grms. per liter.—*Bulletin de la Soc. Chimique de Paris.*

LABORATORY APPARATUS.

Desiccating Case.—On taking them from the stores, the different vessels and capsules containing matters to be weighed cannot be put directly on the scales; they must

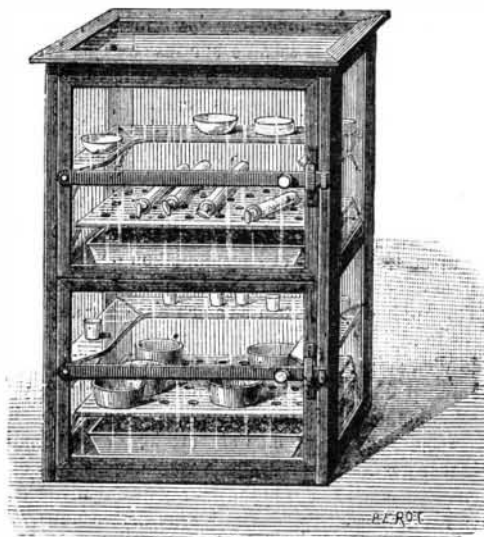


FIG. 1.—DESICCATING CASE.

first be allowed to cool in dry air. For this purpose they are put into a desiccating case. This is a sort of small glazed cupboard, carefully closed, and divided into two equal parts. In each of the latter is placed a porcelain vessel filled with pumice stone, saturated with sulphuric acid. The capsules are placed on a metallic plate pierced with holes, or on glass shelving. The doors of the case are lined with small bands of rubber, thus rendering them as hermetical as possible.

Apparatus for the Extraction and Quantitative Analysis of Gases.—The apparatus shown in Fig. 2 has been used for extracting and analyzing the gases contained in sewer mud, but may also be employed for extracting gases from other substances, such as blood, etc.

The most important part of this apparatus is that placed to the left in the figure, and consists of a receptacle divided into two portions by means of a cock with a wide opening. The lower part is cylindrical, and is closed perfectly by means of a rubber stopper. The upper part, which contains three inflations, is surmounted with a funnel whose tube extends to the lower sphere instead of ending in the second, as represented in the figure.

The uppermost sphere or inflation communicates laterally

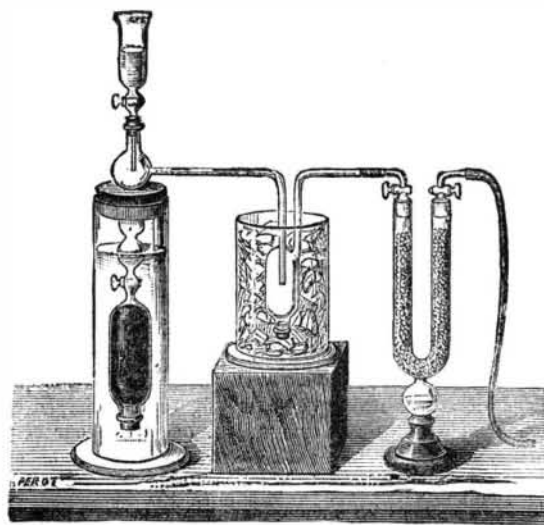


FIG. 2.—APPARATUS FOR EXTRACTING GASES.

with a cooling receptacle, then with a U-shaped tube filled with small glass balls, moistened with concentrated sulphuric acid. This U-shaped tube itself communicates with an Alvergniat mercurial pump, by means of which a vacuum may be formed and the disengaged gases collected.

When it is desired to introduce mud into the apparatus, the receptacle is inverted, the middle cock is closed, the rubber stopper is removed, and the cylinder is filled full of the material. It is then corked up, and the whole is arranged as shown in the cut. Care is taken to grease the external surface of the funnel tube, so that the bubbles of gas disengaged from the mud may burst in the inflated tube. The cocks of the mud receptacle being always closed, the vacuum is formed in such a way as to remove the air from the inflated tube, from the refrigerant, and from the U-shaped tube. Such a result being effected, the cock above the mud is opened. The gases from the latter are

then disengaged, and are collected by means of the Alvergniat pump.

Through the funnel tube there may be introduced a diluted acid for attacking carbonates and sulphides.

CÆSIUM.

ONE of the first fruits of spectrum analysis was the discovery of the two alkaline metals caesium and rubidium, by Bunsen and Kirchhoff. The salts of these metals were closely examined, and found to show a similarity with the compounds of potassium more complete than had yet been observed among analogous bodies. The two metals are the most electro-positive of all known substances, and form consequently the ultimate members of the electro-chemical series, being more positive even than potassium. With this property is naturally combined an exceptional affinity for oxygen, which, especially in the case of caesium, is so great that the isolation of the metal was found impossible, and the discoverers, being unable to separate it from the accompanying non-metals, had to content themselves with the examination of its compounds. Rubidium, however, was isolated by Bunsen, and was described as a light metal deceptively similar to potassium, but much more fusible.

Carl Setterberg has lately effected the isolation of caesium. His method was the electrolysis of a fused mixture of caesium and barium cyanides. Having relatively enormous quantities of the precious materials at command—by means of a process of his own invention he has prepared 40 kilos rubidium, and 10 kilos caesium-alum—he has produced caesium as a metal very similar to the remaining alkali-metals, silver-white, very soft and ductile. Its melting-point is 26.5°, and its sp. gr. 1.88. On exposure to the air it ignites spontaneously, and if thrown upon water it burns like potassium, sodium, and rubidium. Setterberg has proved anew that in consequence of the affinity of the metal for oxygen, and the volatility of its salts, the preparation of caesium by igniting its carbonate along with carbon—according to the ordinary method for obtaining rubidium and potassium—is quite impossible.—*Annalen der Chemie und Pharmacie.*

ORGANIC CHEMISTRY.

THIS name was derived from the fact that at one time all these complex bodies were presumed either to occur in the structures of plants or animals, or to be immediately derived from such. Plants and animals consist of certain organs—that is, instruments or apparatus in connection with which alone life is manifested—and the study of organic chemistry was presumed to relate solely to the bodies forming these organs or to the products yielded by them. Organic chemistry, according to this original view, was the chemistry of vital processes, and any compound, produced directly or indirectly by vital action, was studied under this head. Thus starch, cellulose, sugar, albumen, oil, etc., are complex substances, produced and deposited in the tissues of plants, and other bodies of a similar nature are also found in animal tissues. Then again, the products of the chemical transformation of such substances as we have enumerated belong to the domain of organic chemistry; in this way alcohol is a substance correctly described as organic, for although we are not acquainted with any plant or animal which directly produces alcohol within its tissues, we know that it is a product of the fermentation of sugar, and therefore it is classed among organic compounds. In like manner acetic acid is not found in plants or vegetables, but being produced by the oxidation of alcohol, it is derived directly from organized matter, and is therefore classed as organic. So also with ethers and aromatic bodies, which are derived from organic substances, and we might multiply examples to an indefinite extent. Although no strict line can be drawn between inorganic and organic substances, the distinction is a convenient one, and is sufficiently marked to justify the classification. By many chemists, organic chemistry is defined as the chemistry of the carbon compounds, because it relates solely to bodies containing carbon, that element being an essential constituent of all organized matter, and of all bodies derived from such; this predominance of carbon in organic substances makes them combustible, and therefore organic matter has also been defined as that which is charred and destroyed by heat; but this definition is not a very correct one, as we are now acquainted with many substances undoubtedly of organic origin, which are not charred, or even decomposed, by any reasonable heat. Although organic substances are so much more numerous, and far more complex than inorganic substances, it must be clearly borne in mind that they are subject to precisely the same laws, and are built up and transformed by the same influences which affect inorganic bodies. In addition to carbon, which is the essential element, oxygen, hydrogen, and nitrogen, and occasionally sulphur and phosphorus, enter into the composition of organic substances, and we also often find certain mineral substances allied with organic compounds, especially in such as are directly derived from plants and animals; these mineral constituents are left behind when an organic substance is submitted to prolonged ignition, and they constitute what is called the ash.

Isomerism.—This term, which is derived from two Greek words, signifying "equal" and "part," is applied to a phenomenon which is repeatedly observed in the study of organic chemistry. Substances are said to be isomeric when they possess the same percentage composition, but differ in their chemical and physical properties. Organic chemistry abounds with such examples; thus taking cellulose, starch, and dextrine, three substances met with in grain, and known to every brewer, it will be seen by the following table that they possess the same percentage composition, but, as will be pointed out in greater detail, when each substance is fully studied, they differ materially in chemical and physical properties:

	Cellulose.	Starch.	Dextrine.
Symbol.....	$C_{12}H_{20}O_{10}$	$C_{12}H_{20}O_{10}$	$C_{12}H_{20}O_{10}$
Percentage of carbon.....	44.4	44.4	44.4
Percentage of hydrogen..	6.2	6.2	6.2
Percentage of oxygen....	49.4	49.4	49.4
	100.0	100.0	100.0

Cellulose, starch, and dextrine differ from each other; the first-named is completely insoluble in water, the second is only soluble at high temperatures; and the third is completely soluble in the cold. Again, each of these substances gives a different reaction with iodine, and their general appearance and physical properties also greatly differ. The chemist attempts to explain this remarkable phenomenon by assuming that the individual elements in isomeric compounds