the hollow being greatest in those parts corresponding with the dark parts of the picture, and everywhere deep in proportion to the intensity of the shade. I place this mould in a dish containing blackened water, so that the water just runs over its face. You now see no picture or anything approaching to a picture. Now notice the effect of pressing a piece of plate glass down on the surface of the mould. The excess of the blackened water is forced out, and the hollows of the mould alone are filled up with the blackened water. Now, as these hollows vary in depth, varying degrees of shade are produced, and a perfect picture is produced. I take the glass off, and the picture disappears; put it on once more, and it reappears. Instead of colored water, I pour on this mould a little colored gelatine and press a piece of plate glass down on the surface. The excess is forced out and the mould filled with colored gelatine. In a few seconds the gelatine will have set, and I shall be able to lift off the glass, which will carry with it the gelatine image. Here it is; it forms a transparency suitable for the magnetic lantern. If, after having flooded the mould with colored gelatine, a piece of paper is laid on, and the excess of gelatine is forced out with a plate of glass, a picture composed of colored gelatine is moulded on the paper, and can be removed as soon as the mould is set. When removed it is dipped into a solution of alum, in order to render the gelatine image insoluble in water.

So much for the general principles of Woodburytype; and now let me show you how you can work this process yourselves.

The first thing is to dissolve about six parts of easily soluble gelatine and two parts of lump sugar in fifteen parts of warm water. Here is the warm mixture already strained through muslin, and here is a waxed glass plate, set level, and bordered with a little ledge of wood. The warm gelatine solution being poured on, spreads itself over the plate, forming an even layer, which, in the course of some hours, will dry, forming a uniform sheet. Well, here is a dry sheet of the gelatine on another piece of glass, and you see that the introduction of a penknife under one corner of the gelatinous sheet brings it off the glass at once. The next thing is to make this gelatine sensitive to light, and for this purpose it is soaked in a solution of potassium bichromate, containing 3½ per cent. of the salt. You see that it has now become quite flaccid by absorbing the solution, and I now lay it on a sheet of glass and remove the excess of solution by means of the squeegee. The bichromated gelatine adheres to the glass, but when dry it will be easily removable.

Here is a glass plate, with a dry sensitive film on it. I take the film off and place it under a negative. It is now ready for exposure to light, and would require about two hours of such light as we had to-day at noon. Here is a printing frame containing three such films, which have had the necessary exposure under their negatives. I put these films in water and let them get moderately soft, but not so soft as the film became during the sensitizing. One of these I take out and lay face downward on a piece of finely-ground glass, another is similarly placed on a piece of glass covered with gold-beater's skin, and the remaining one is put down on a sheet of collodionized glass. The squeegee is now applied to each, and adhesion takes place. In order to enable the gelatine films to firmly fix themselves to the supports, they should remain at rest during a period of about half an hour; but as we cannot wait that time, I have provided a duplicate set previously prepared. Mr. Barker will now put these into warm water, and the gelatine soon begins to dissolve. Now, remember that certain parts of the bichromated gelatine have been made insoluble by the action of light shining through the negative, and these insoluble parts will remain undissolved on the supports (ground glass, gold-beater's skin, and collodionized glass). It will take some little time for Mr. Barker to wash away all the soluble gelatine, but toward the end of the lecture you will see his results in the shape of gelatinous reliefs; thick where corresponding to the blacks of the picture, very thin in those parts representing the whites, and finely graduating between these extremes. When the reliefs have been sufficiently developed they must be dried, and here is a finished and dry set. You see that, having only one hour, it is necessary to get continually in advance of the work, and to take fresh materials which have been previously worked up to a certain stage. Let me begin with the relief on finely-ground glass. This being gently warmed, I put a border of wood round it, and pour on some fusible metal, made by melting together one part of cadmium, two parts of tin, four parts of lead, and seven parts of bismuth. Well, now, if I left this to cool in the ordinary way, the top would solidify first, and the lower layers of metal in contracting would leave small vacant spaces next to the surface of the gelatine, thus rendering the cast imperfect. To obviate this, I place the glass on this cold block of metal and cover the top of the fluid fusible alloy with warm sand. The rest explains itself—the portion of fusible alloy next the face of the mould becomes solid first. Here is a fusible metal mould made in the way I have just illustrated to you; I oil it slightly, pour some colored gelatine solution on it, and force away the excess by means of flat glass; and when the gelatine has set the glass can be removed, carrying with it the moulded transparency.

Here is the relief on gold-beater's skin, and here is the one which was developed on collodion. These can easily be stripped from their glass supports, as I now show you—one corner being liberated, off they come; I will pass them round for you to look at. Now, in the actual commercial practice of Woodburytype printing, a film relief, such as you are now passing round, is forced into a plate of lead by means of the hydraulic press, and the leaden mould thus obtained is used for printing. I now lay a film relief on the smooth steel base of this screw press, place a piece of lead on the top, and apply pressure. You see the result—the lead has become an exact counterpart of the gelatine relief, which, you will notice, is in no way damaged.

Here is a leaden mould, together with the corresponding relief, kindly supplied by Messrs. Braun & Co., of Dornach, and here is a very fine mould made by Mr. Woodbury himself. I will make a cast in this, and you see that the result is one of Mr. Woodbury's magnificent lantern slides, which are now so popular. It is now projected on the screen, and you can all see it. I take it out, or the heat would melt the wet gelatine, and I pass it round for you to examine, but remember that it is not yet dry, so do not touch the face of it.

I think I explained to you that, in order to get a Woodburytype picture on paper, it is merely necessary to interpose paper between the gelatine, as poured on the mould, and the plate-glass cover, which forces out the excess. To illustrate the matter, I will print one from this mould. Now notice the paper I use. It is thin, hard paper, surfaced with shellac, to prevent the gelatine from penetrating it, and heavily rolled, to make it even in thickness. There is much more which I should like to tell you about the Woodburytype process, but I have not time. You will not fail to notice the admirable collection of prints and illustrative specimens kindly lent me by the Woodburytype Company, Messrs. Goupil & Co., Braun & Co., Bruckmann, and others, who are working the process on a large scale, not forgetting these very fine specimens lent by Mr. Woodbury himself.

I may mention that, in actual practice, one Woodburytype printer can attend to several moulds, and by the time he has filled the last of the series the first is ready to give up its picture. The moulds are arranged on a circular table, which revolves in front of the operator.

Mr. Woodbury has modified his process so as to obtain copper plates suitable for deep printing in the ordinary copper-plate press, and this modification has been worked with the greatest success by Messrs. Goupil & Co., of Paris, who have kindly lent me these magnificent specimens of their work.

A gritty powder is added to the gelatinous mixture employed for making the relief, and, when the relief is made, it is found to be more or less rough, from the projection of the gritty particles. The relief is then rolled against a sheet of lead, so as to make a perfect reverse in this metal. As far as form is concerned, this plate of lead is perfectly adapted for printing in the copper-plate press, the hollows left by the projecting particles of grit holding the ink to perfection. But as lead is much too soft to be used as a deep-printing plate, the leaden plate is reproduced in copper by the electrotype process, two electrotypings being, of course, necessary, one to make a reverse mould and a second to make a cast of this mould, or a duplicate of the original leaden plate.

BLOWPIPE CHEMISTRY.

By P. Casamajor.

I. THE SHORTEST POCKET BLOWPIPE.

Over two years ago I published in the *Chemical News* (vol. xxxiii., p. 50), and in the *American Chemist* (December, 1875), a description of a blowpipe, which, when packed for the pocket, has a length of 4½ inches, and, when adjusted for use, gives a length of 8 inches from the mouth-piece to the tip of the jet. This relation of 4½ to 8 was a trifleless than that of any pocket blowpipe that had previously been proposed.

In the above description, as published in the *Chemical News*, occurs the following: "If the stem of the blowpipe is made

Fig. 1 (full size).

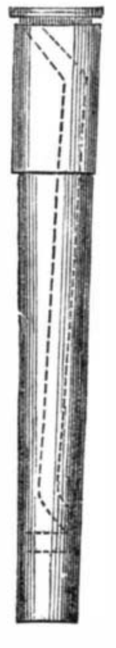
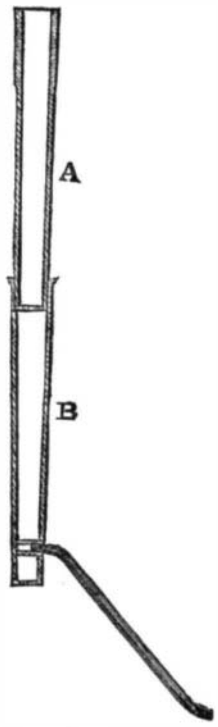


Fig. 2 (scale ½).



in two pieces, while the jet is made with a double curve, the length, when put up for the pocket, can be reduced to 3¼ inches, which gives the still smaller ratio of 3¼ to 8, which, I believe, has never before been attained. I have one of these dimensions whose stem is formed of two conical portions with circular sections. When packed for carrying, one cone fits into the other, and the curved jet fits within the inner cone."

As neither at the time of publishing the above, nor since then, has the figure or a detailed description of this blowpipe been given, I propose to give both now, as I believe that this blowpipe still enjoys the distinction of being, when packed for the pocket, the shortest ever made. In Fig. 1 it may be seen in this condition, and in Fig. 2 it is shown as arranged for use.

In this figure we may see that the stem is formed of two conical tubes, A and B, of about the same length. The small end of A enters into the large end of B. The larger end of A is left open, while its smaller end is closed with a plate having a hole in its center, to allow the passage of the air into B. The conical tube B is also open at its larger end, but closed by a plate at its smaller end. About half an inch from the smaller end is an opening in the tube B, made to receive a small piece of pipe, which is soldered to edges of the opening, and to a place inside of the tube, B, diametrically opposite to the opening. This short piece of pipe, which serves as a socket to receive the jet, is provided with a hole to allow the air to escape from the tube B into the jet.

A blowpipe of this kind is very easily made by taking two ordinary jeweler's blowpipes, which cost about 15 cents apiece, and filing off the curved portion. There remain two straight conical tubes, which are placed one within the other. We may then cut from the outside tube a piece about 3 inches long, from which we make the tube A. At the smaller end is soldered a perforated plate. From the inside tube we make the pipe B by closing its smaller end with a plate and by putting a ring around its larger end. This ring answers the purpose of stiffening this end and keeping its shape true, and it also serves to take hold of when the tube B is to be drawn out of the tube A (Fig. 1). The perforated plate at the smaller end of A is also designed to keep this end from deformation. It also serves as a diaphragm with a small perforation to divide A from B, which allows the stem to be divided so as to leave a lower chamber, which some think is an advantage in the case of the blowpipe of Gahn, commonly ascribed to Berzelius or Plattner.

It may be noticed in the figures that the larger end of A is made thicker than the rest of this tube. This extra thickness represents a silver tube soldered over the brass tube in the part that enters in the mouth.

The jet is made from a piece of brass tubing. Before curving it, it should be filled with rosin, to prevent it from collapsing. This jet should be made to fit very accurately in a larger piece of tubing, which is afterward soldered in the tube B, to serve as a socket for the jet, as shown in Fig. 2. To prevent the jet from dropping out of the inner tube, this is closed with a cap, the edge of which is shown in Fig. 1.

II. CHARCOAL BORERS.

In his excellent work "On the Use of the Blowpipe in Chemical Analysis and Mineralogical Determinations," Berzelius gives a charcoal borer, which is remarkable for its

Fig. 3.

extreme simplicity. It consists in a conical tube of tin plate, open at both ends, these ends being sharpened with a file, so as to present two circular edges. By using either the larger or smaller end of the cone we may bore holes of two different sizes in charcoal. The diameter of the larger end is about half an inch, and that of the smaller about a quarter of an inch.

This borer is not generally known, those of Plattner being the only instruments of the kind in general use. These have the advantage of making a hole more quickly, and they never leave a core, which, in the case of the tubular borer, has to be removed afterward with some care. Plattner's large borer gives a cavity with a rounded bottom like that of a crucible, which is often an advantage. These borers of Plattner are somewhat expensive, and also quite difficult to make, so that if a chemist was in a locality where they could not be bought he would not find it an easy matter to make them for himself.

I have been using for several years a form of charcoal borer which works with great rapidity and perfection, and which is of the easiest construction. The holes made by this borer are cylindrical, or slightly conical, with flat bottoms. Quite lately I have devised another form which gives cavities with curved bottoms like Plattner's larger borer, and which is also of the simplest construction, so that any one may, with little trouble, make one for himself.

The first of these forms is the conical tin tube of Berzelius, with two modifications, one of which consists in making each base of the tube not a complete circle, but about three-quarters of a circle, as represented in Fig. 3, the object of which is to facilitate the removal of the core, as will be explained. The other is that the edges of each end are not like the edge of a knife, as in the tube of Berzelius, but like the edge of a saw.

Fig. 4 represents a side view of this borer. At each end of the tin tube it may be seen that a portion, about a quarter of the metal, has been cut away. The middle portion of the tube is left entire, and the edges at this portion should be brazed or soldered together to insure stiffness. Fig. 5 shows the shape of the sheet metal from which the borer is made. The edges, *a* and *b*, are to meet or overlap, and are to be brazed or soldered together.

This borer gives well-shaped holes with remarkable quickness. When the hole has been made deep enough the core is easily detached by pressing the tube against it, so that the core is pushed into the free portion of the groove, which corresponds to the part which has been removed from the conical tube.

If a borer of this kind is made with a large diameter, so as to leave a thick core which is not easily detached, a smaller hole may be bored in the core with a smaller instrument, after which the core is easily broken up and removed.

By alternately bending the teeth at the bases of the cone outwardly and inwardly, as in the operation called *setting* for carpenters' saws, a wider groove is left around the core, which is more easily detached when the borer is of large size.

The charcoal borer which gives cavities with curved bot-

Fig. 4.

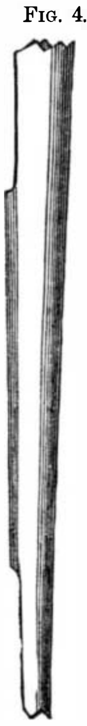
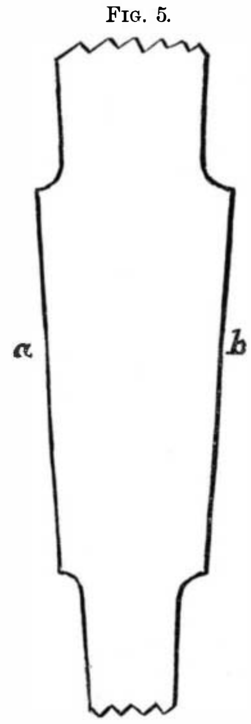


Fig. 5.



toms is made by cutting a plate of metal so as to give it the shape shown in Fig. 6, and bending over perpendicularly to the surface of the plate the portions at each end which project beyond the dotted line. These projections are bent in opposite directions, as shown in Fig. 7. The dotted lines which show the outline of the borer form an ogive, which gives a good-shaped cavity. The portion beyond the dotted line which is bent perpendicularly to the face of the plate, as we have already said, should have its edges sharpened ith a file to enable the borer to work more rapidly.

By pressing this borer against a piece of charcoal, and turning it alternately to the right and to the left, a good cavity is obtained in a very short time. Borers of this kind should be made of pretty stout metal, as otherwise they become twisted by use. Tin plate known in the trade as *three cross* is sufficiently thick for the purpose.

III. SHEET-IRON SUPPORTS.

I have been using for some time pieces of sheet iron for supporting substances before the blowpipe flame. Sheet iron presents several advantages for this purpose, in being very common everywhere, in costing little or nothing, and in being durable, so that the same piece may be used over and over again many times. We cannot on a plate of this kind exhibit the action of fluxes which attack iron, but we may see with distinctness the rings or deposits that are given before the blowpipe flame by antimony zinc, bismuth, etc.

We may also obtain copper, lead, silver, tin, bismuth, etc., in the metallic state by the reducing flame, particularly in presence of carbonate of soda or cream of tartar.

To use sheet iron as a support it must, in the first place, be rubbed with a piece of pumice or of Bath brick and water, until the plate looks bright. Thereby all dirt left by a previous operation and all rust are removed. Before placing anything for testing on the plate it is advisable to blow the blowpipe flame on it for a few seconds, when it becomes covered with a shining dark gray coat of magnetic oxide, on which the rings or deposits are seen with distinctness. We may, if we think preferable, cover the plate with a coat of soot by holding it in the flame of a lamp or candle. On this coat the deposits take place equally well.

I generally use the thinnest sheet iron obtainable, which is the kind on which are taken the photographs called *ferrotypes*. Sheets of this thickness are easily bent into any convenient shape. They may be used over and over again without any perceptible diminution of their thickness.

Iron has the advantage of being relatively a poor conductor of heat, which property enables us to hold in the hand one end of a piece of sheet iron not more than 4 inches long, while the other end is in the blowpipe flame. If a handle is found necessary, the piece of sheet iron may be held in a cork provided with a cut in which to insert it.

If we should want to use charcoal, I may point out that we can use a metallic plate as a charcoal holder, by making two slits crossing each other at right angles, and bending the four tongues obtained in this way, about perpendicularly

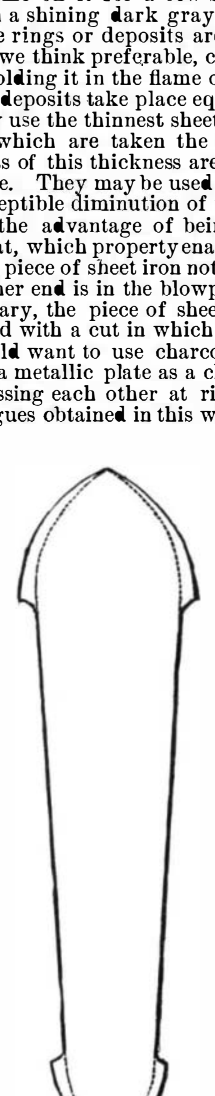


FIG. 6.

FIG. 7.

to the surface of the plate. In a hole thus made in a plate it is an easy matter to hold tightly a small piece of charcoal by bending the four tongues more or less. The ring formed by the action of the flame may extend beyond the charcoal on the metal plate. This is in imitation of the plan proposed by Prof. Le Neve Foster of using a plate of unglazed porcelain provided with a cavity for holding a piece of charcoal.

We may, instead of this, make a cavity in a piece of sheet iron by indentation, and fill it with a paste made by mixing the substance to be tested with an excess of charcoal powder or black flux and a little water. After heating the mass we may obtain the metallic particles by triturating in a mortar with water and washing away the residuary carbon. If deposits are formed they will be found on the sheet iron around the cavity.

IV. ALLOYS OF LEAD AND TIN.

The reactions presented by alloys of lead and tin before the blowpipe flame are of such interesting nature that I need no apology for bringing them to your attention. I am not aware that the behavior of these alloys has been specially noticed, with the exception of a brief note in an excellent paper, by Prof. Chapman, of the University of Toronto, "On Some Blowpipe Reactions," in *Chemical News* (vol. xxxv., p. 13). In the ninth section of this paper, relating to alloys, occurs the following: "*Lead and tin* unite readily, but the globule commences immediately to oxidize, throwing out excrescences of white and yellow oxide. On removal from the flame it still continues in ignition, and pushes out further excrescences. The unoxidized portion, if any, is malleable."

The reactions presented by alloys of these two metals had already attracted my attention when this note was published, as I wrote at the time to Prof. Chapman, in the course of a lively but very friendly correspondence on the occasion of his strictures on Turner's test for boracic acid.

The following experiments illustrate the points of interest in alloys of lead and tin: they were all tried with 6 decigrms. of alloy made from pure lead and pure tin:

Experiment 1.—Melted together 3 decigrms. of lead and 3 decigrms. of tin. By continuing the heat before the blowpipe the alloy gives small bunches of excrescences, resembling cauliflowers. After awhile the excrescences increase progressively as the blowing continues. They are at first white, afterward yellowish. Finally the whole mass resolves itself into cauliflowers of deep orange color. During the formation of these excrescences copious white and yellow fumes are given out and deposited on the charcoal.

Experiment 2.—The 6 decigrms. of alloy are formed of 4 of lead and 2 of tin. In this case the reaction is violent from the very first. The bunches of cauliflowers, of a deep yellow color, are formed as soon as the metals are heated. On ceasing to blow, the reaction goes on in a lively manner. Thick fumes are given out and deposited on the charcoal.

Experiment 3.—The 6 decigrms. are formed by taking 4 of tin and 2 of lead. In this case the cauliflowers only begin to form in small bunches of white color after persistent blowing. Fumes are given out slowly, and a malleable button is left.

Experiment 4.—Lead, 5 decigrms.; tin, 1 decigrm. After blowing a short time the deep yellow cauliflowers form, until the whole mass is oxidized. The reaction is apparently less violent than in Experiment 2.

These experiments show that when the lead is double of the tin the reaction takes place ith more energy than with any other proportions. This is worthy of attention, because the atomic weight of lead (207) is nearly double of the atomic weight of tin (118). It makes it probable the deep yellow cauliflower-like excrescences are a stannate of lead. These reactions, with an alloy in which the weight of the lead is double that of the tin, also show that this alloy, when heated, absorbs oxygen with exceeding avidity, which fact may find future applications.

Although an alloy of these proportions absorbs oxygen with great avidity, Experiment 4 shows that an excess of lead does not seem to interfere in a marked degree with the reaction.

Experiments 1 and 3 were made with excess of tin, which, contrary to what takes place with lead, interferes with the formation of the excrescences.

In Experiment 3 the tin was in large excess, and the reaction was very indistinct.

A point of interest in connection with these reactions is that although tin does not give any fumes, and that those given out by lead are very slight, alloys of these two metals give fumes which are excessively abundant, and which might mislead a person who is not on his guard to believe that zinc or antimony is present.

As both lead and tin are ordinary blowpipe reagents, it may be as well to suggest that when either of these bodies is suspected in a metallic substance to be tested, the addition of the other may furnish useful evidence. As the specific gravity of lead is 11·4 and that of tin 7·5, we may, without weighing, get approximately at the quantity of either of these metals to be added by estimating the volume.

As an application of the foregoing I may mention that the bright foil called tin foil—which is so extensively used in this country for wrapping around substances to be used for food—must, from its behavior before the blowpipe, contain about twice as much lead as tin. I have not determined these proportions quantitatively.

In some works on the blowpipe it is mentioned that when a button of tin is strongly heated before the blowpipe it continues to burn after the flame is withdrawn. I have never been able to obtain this reaction with pure tin, but it takes place readily when lead is present with the tin in sufficient quantity. The tendency to oxidation is so great in a button of alloy in which the weight of lead is double that of tin, that I do not believe that even the most expert operator would be able to keep a button of this kind from oxidation in the most perfect reduction flame that could be obtained.

V. REACTIONS FOR IODIDES, BROMIDES, AND CHLORIDES.

Several years ago Von Kobel observed that when sulphide of bismuth is heated on charcoal with iodide of potassium, a bright red coat of iodide of bismuth is obtained. From this he proposed a mixture of equal parts of sulphur and of iodide of potassium for the detection of bismuth, which he succeeded in finding in a mineral, accompanying joseite, in which it had never been suspected. Prof. Cornwall shortly after proposed the same reaction for the detection of bismuth in the presence of lead and antimony.

The ready formation of iodide of lead, by heating a plumbic compound with the mixture of sulphur and iodide of potassium, induced me to try the detection of iodine by heating an iodide with powdered galena. The characteristic yellow coat of plumbic iodide is deposited as soon as the flame touches the mixture. By heating chloride of sodium with galena an abundant white coat of oxychloride (?) of lead is deposited. With bromide of potassium and galena a white deposit of plumbic oxybromide (?) is obtained. When iodides, bromides, and chlorides occur together, it is not possible to separate them by the use of galena, as a yellowish white coat is deposited when an iodide is mixed with either a bromide or a chloride, from which I have found it impossible to separate the yellow from the white.

If, however, instead of galena, we use a mixture of sulphur and bismuth, in connection with a mixture of an iodide with a chloride, we will obtain a yellowish coat, and beyond this red streaks. At first this result is not very promising, as the yellowish deposit resembles a mixture of iodide of lead with chloride of lead. But if we let the plate cool, and afterward heat the yellowish deposit very slowly and carefully, the yellowish coat will separate into an outer ring of bright red iodide of bismuth and an inner ring of oxychloride (?) of bismuth, which, on cooling, becomes perfectly white.

If we try the same experiment with a mixture of bromide and iodide the result is not quite so satisfactory, for although the yellowish coat—resembling that of the preceding case—becomes white on heating, the heat necessary for this causes the iodide of bismuth to be driven beyond the plate, and, although the red fumes are distinctly seen to escape, the red iodide does not remain as a witness on the plate. We may, however, by using an open tube, and by placing the mixture to be tested at one end of this tube, drive the mixed fumes of oxybromide (?) and iodide of bismuth up the tube. If afterward we heat slowly and carefully the deposit near the end of the tube to which heat was previously applied, the white oxybromide (?) will remain, and the bright red fumes of the iodide will be driven further up the tube and deposited on its sides.

By means of a mixture of sulphur and bismuth we may, then, separate iodine from bromine and chlorine, but the separation of bromine and chlorine from one another is not possible with sulphide of bismuth.—*Chemical News.*

OPTICAL DEFECTS AND SPECTACLES.

By DUDLEY S. REYNOLDS, M. D., Louisville, Ky.

AN optical defect is a condition wherein the optical properties or refracting power of the eye is such that rays of light passing through the pupil are not focused in the bacillar layer of the retina.

The general divisions, hypermetropia and myopia, refer to conditions directly opposite each other; one being due to insufficient converging power in the crystalline lens, the other being due to an abnormal increase of the distance between the lens and retina.

In hypermetropia of high grade light is not focused at all; while in every form of myopia the light is focused before it reaches the retina; so that in both conditions the visual power is defective, for want of proper adjustment of the refracting media. Hypermetropia may be simple, uniform, irregular in the different meridians, or compounded with myopia; as, for instance, in the eyes of some a certain meridian is found to be hypermetropic, while the opposite meridian is myopic. Analogous complications are frequently found in myopic eyes.

The changes which are brought about by age limit the focusing power, or accommodation, thus diminishing the refraction, and giving rise to a condition practically identical with hypermetropia. Hypermetropia less than one-twelfth is likely to be overcome by straining the accommodation power until the subject attains adolescence, except in those cases wherein the defective refraction is greater in one eye than in the other; squint arises from the unequal adjustment, the great strain upon the accommodation in the one eye used produces muscular asthenopia, or spasm of accommodation, and the patient is forced to seek relief. When the hypermetropia is concealed by the excessive power of accommodation, Mr. Laurence thinks spasm of accommodation exists. This is far from the truth. Spasm of accommodation of the eye is one of those excruciatingly painful states often described as ciliary neuralgia, and cannot be relieved without removing the necessity for that strain which the defective refraction entails.

The almost universal practice of correcting only a part of the defect at a time, gradually increasing the power of the lenses until the error of refraction has been overcome, is not founded in reason, nor is it justified by any man's clinical experience. Donders says, and all the world bow in humble submission to his dictum, that where the error of refraction is different in the two eyes, glasses of equal focus should be ordered, in accordance with the defect in the eye least affected. This is an error; allowing that the accommodation is about equal in both eyes—and it has been observed to differ in the rarest cases only—whatever defect of refraction may be found should be carefully and entirely corrected, testing always each eye separately; then the accommodative power has but the normal amount of labor to perform; and, no inharmonious work being required, every source of difficulty in the way of defective vision is removed.

Donders says where astigmatism amounts to less than $\frac{1}{40}$ its correction need not be attempted. This error has been a fruitful source of glaucoma; in many instances it has caused posterior staphyloma.

I have been often consulted by persons suffering with asthenopia, and sometimes with spasm of accommodation, who informed me that they had been to some famous confrère, who had ordered glasses, and while some benefit had been derived, the weariness, or pain, had returned. Careful testing revealed irregular refraction of low degree, often as low as $\frac{1}{90}$; this being corrected, years of literary labor failed to reproduce the trouble, thus proving the necessity for full correction of the entire deficiency of refracting power.

On the 16th of October, 1876, I was consulted by a lad, thirteen years of age, who had been the rounds of the profession, receiving glasses from each specialist consulted, and, being still unable to read without pain, was obliged to quit school. He had been ordered spherical glasses, $+\frac{1}{30}$ to $+\frac{1}{60}$, all of which improved vision; but the pain would return, and, in a few minutes, reading became impossible. Using a four-grain solution of sulphate of atropia twice every day, in two weeks the pain had entirely ceased; the accommodation being full paralyzed, I found astigmatism $= +\frac{1}{80}$ in the right eye, and $+\frac{1}{90}$ in the left. The spherical aberration being $= +\frac{1}{48}$ in the right eye, and $+\frac{1}{60}$ in the left. Compound cylindrical lenses adequate to the correction of these seemingly small deficiencies of refraction gave perfect immunity from pain or fatigue, and the lad has gone on with his studies uninterruptedly since he began to use the glasses.

In correcting defects of refraction it is always important to have the accommodating power wholly suspended. Where this is partially done, or not regarded at all, success is impossible.

That the advance of civilization is attended with an increasing number of near-sighted eyes, and that this is largely due to a lack of early correcting congenital defects of refraction, is no longer to be doubted. The more general diffusion of educational advantages calls for more general use of the eyes for near and accurate vision, and where errors of refraction exist uncorrected, the constant strain of accommodation so augments the tension of the eyes as to produce inflammatory changes in the posterior part of the globe, ending in staphyloma posticum, and its almost necessary accompaniment, myopia.

No mention is made here of that class of defects due to age, because presbyopia depends upon such senile changes in the structure of the lenticular body as tend to reduce the power of accommodation rather than to increase it, consequently no serious effects are likely to result from neglecting to correct it.

The subjects herein briefly treated are of such great importance to the general practitioner, as well as the specialist, that I feel no apology is due from me for introducing a matter so purely scientific. There is too little attention paid to the early correction of optical defects, and too much aversion, in this country, to the use of spectacles. The sooner these prejudices are overcome, the sooner will there be a decrease in the number of blind people. And it is time the medical profession should cease to encourage the itinerant spectacle vender, for no one but a practical ophthalmologist is competent to say when we shall wear glasses, what kind we shall wear, and how we shall wear them.—*Med. and Surg. Reporter.*

TREATMENT OF TYPHOID FEVER.

DR. J. R. GROOVER, of Mica, Pickens County, Ga., writes to the Atlanta *Medical and Surgical Journal*:

I propose briefly to give a plan for treating typhoid fever that has proved very successful in my hands, having used it in a great many cases during the past three years:

Diluted phos. acid, 20 gtts. every four hours through the day, alternated with a powder composed of ipecac, camphor