

its elevation or according to its plan. Any striated Venetian glass affords a type of the one proceeding, any ringed clay vessel of the other. The glass blower arrives as naturally at the one as the thrower or turner at the other.

Another way is to cross the shape diagonally, which results in the appearance of twisting, as may be seen very often in silversmith's work. Of course these systems may be associated, and they often are, as in the German tankards of the 15th century, where the bulbous bowl is beaten out into the semblance of a melon, and the neck and foot are simply turned.

Now the decoration of a vase lengthwise, according to its elevation, corresponds to the striping of a panel with vertical lines; the decoration bandwise, according to plan, corresponds to the striping of a panel with horizontal lines; and the twisted treatment corresponds to a series of diagonal lines crossing a panel.

The way in which medallions, panels, and other shapes may be incorporated with the design of a vase is not different from that already described. There is, however, this difficulty, that any marked independent shape is likely to interfere with the form of the vase, or the form of the vase to interfere with it, as is the way with the landscape and picture medallions so persistently misapplied to Sevres and Dresden china. Not that it is at all impossible to introduce such features with good effect; only it needs to be done with judgment, which of all things is most rare. And, as it happens, the difficulty has been more often attacked with valor than with that discretion which is reputed to be its better part.

The decoration of the circular plane involves new forms rather than new principles. The circle is most naturally divided either into rays or into rings. In the one case the radiating lines answer to the division of a rectangular space by vertical lines. In the other the rings answer to the horizontal lines dividing a panel. This is easily shown in Fig. 13.

Imagine a series of upright lines, A, to represent the folding of a sheet of paper. You have only to gather the folds together at one end, after the manner of a fan, B, and you have the system of radiation. Repeat the fan shapes side by side, and you soon arrive at a circle divided into rays, C.

Again, in the case of a series of horizontal bands, D, you have only to suppose them elastic enough to be bent, and you have a series of concentric arcs, E, so many slices, so to speak, out of a circle decorated ringwise, F. The same target-like result may be arrived at by the continuation of a series of borders round the circle, one within the other. That is only another way of reaching the same point in design. The crossing of the two schemes, G, is much the same thing as a square lattice of cross lines in a rectangular panel. The subdivision of the circular space by lines of more flowing character, H, would correspond to the division of the panel by diagonal lines; and if those lines were crossed, J, it would be analogous to the division of the square by cross lines into diamonds. The spiral line, as applied to the decoration of the circle, K, is equivalent to the fret or key pattern as applied to the square, L. These analogies, I think, are plain enough.

All manner of independent shapes may be introduced into the decoration of the circle, as into that of the panel. One may plant a shield in the center, and surround it with a border. One may associate any arbitrary form with ringed or radiating lines. But should any such shape form an important feature in the design, the situation is not so free from danger. There is a limit, that is to say, to the arbitrariness with which prominent lines or forms may judiciously be introduced into a circular design. Anything which counteracts the space you have to fill needs to be accounted for. The difficulty in dealing with forms contradictory one to another is that you are apt to leave interspaces of irregular shape, which are not very manageable, as, for instance, in the inevitable spandrel which occurs so frequently in architecture. If it happens to be very large, you can insert into it a more regular shape, which will hold its own; and if it is insignificantly small, you may ignore it. You may, if it is of importance enough to be accepted as an individual panel, treat it as such, with figures, scroll, and so on. Or you may simply cover it with an unimportant pattern in the nature of a diaper. These are the extremes. But the happy mean in spandrel decoration is not easy to find; and the spandrel may be taken as the type of all awkward shapes produced by the intersection of curved lines with straight. Ornamental design would be a much easier thing if we had only to consider the lines of the ornament, without any regard to the interspaces.

From the decoration of the circle to that of the rosette is only a short step. What applies to the vase shape applies to the column, baluster, pedestal, and so on. The triangle offers no new difficulty. A branched form may be looked upon as an assemblage of familiar parts, the Greek cross, for example, as an assemblage of five squares. An altogether exceptional space will be pretty sure to indicate of itself the exceptional lines on which it can best be decorated, and a capricious one may well be left to the caprice of the artist.

Entirely apart from the question of the skeleton of your design is the consideration as to whether it shall be looked at primarily from the point of view of line or of mass. In any satisfactorily completed scheme, lines and masses must alike have been taken into account; but the artist must begin with one or the other, and the result will probably be influenced by the one or other consideration which was uppermost in his mind. Which of the two it may happen to be, is more often a matter of temperament than of choice with him.

The primary consideration, whether of line or mass, will always lead the designer, though perhaps unconsciously, to adopt a plan accordingly—that is to say, the preference for mass will lead him to attack his panel resolutely, planting shapes upon it which it will be his business afterward to connect by means of the subsidiary lines needful to the completion of the scheme. On the other hand, a greater partiality for line will induce him to have recourse to a more orderly procedure; will, perhaps, even suggest a geometric groundwork, which, however far he may depart from the first lines, will materially help him in securing the object he has most at heart.

If you start with certain arbitrary and irregular forms, so many patches, as I may say, on the panel, it is clearly not such a very easy matter to connect them by any systematic lines of ornament. If, on the con-

trary, you begin with some system of orderly lines, these must necessarily determine in some measure the shape and distribution of any more prominent features you may thereafter introduce into the scheme.

For my own part (while I disbelieve entirely in arriving at anything more than mediocrity by the adoption of set rules of proportion), I feel rather strongly that there should be by right a strict relation between the parts of the design, however little it may be obvious. If, for example, there is a space to fill between border and central medallion, a diaper may be enough; but the diaper should be designed into its space. And even if part of a design be permitted to disappear, as it were, behind this feature or that, it should be so schemed that no very material form is

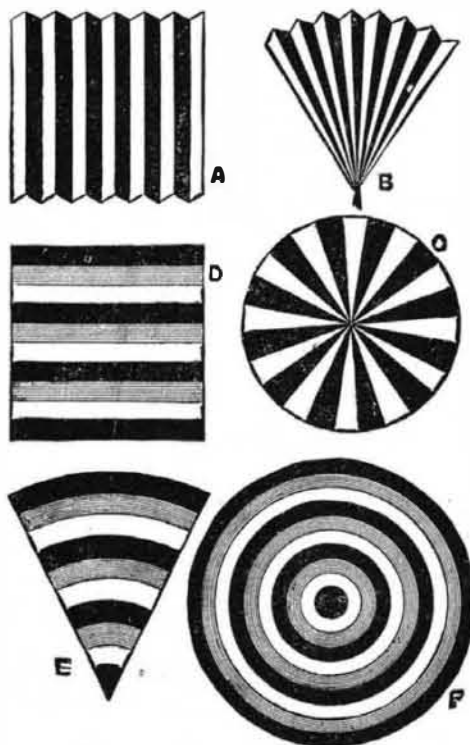


FIG. 13.

mutilated in the process. Where an interruption occurs in a border, the pattern should be planned with a view to such interruption. Even though you deliberately adopt a diaper as a background, the character of that diaper should be determined by the scroll, notwithstanding that the lines of the one are meant to contradict the lines of the other. It is not enough casually to employ any diaper. In the early English glass to which I referred a while ago, the overlapping patterns were designed to overlap. The spaces between one series of medallions suggested the shapes of the minor medallions between, which were shaped with a view to interruption. The careless overlaying of one pattern, or of one scheme, by another is the merest makeshift for design.

You will find invariably that the apparently "accidental" treatment, when it is at all successful, is not quite so much a matter of accident after all. There has been no disregard of the laws of composition, but only the omission of some accustomed ceremonial. To take what might seem a flagrant instance of the disregard of an obvious rule of art. There is a drawing on the walls of a cabinet by Boule, in which the doors are treated as one panel, notwithstanding their actual separation by a pilaster between them. However wrong in theory this may seem, in practice it proves to be not so unsatisfactory. And for this reason—that

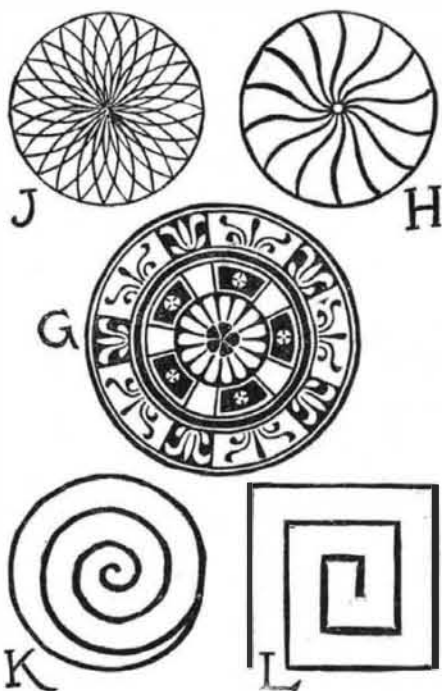


FIG. 14.

the upright intervening space was, as a matter of fact, very carefully taken into account in the design. The artist chose to make it less emphatic than its position would have suggested to most of us it should be. But he did not really ignore it. Very far from it. Had he disregarded the construction, the jar would have been very perceptible. If he succeeded at all in satisfying the eye, it is because he did with great deliberation and judgment what might easily be mistaken by the inexperienced for an inconsiderate thing.

It is when such things are undertaken by the novice, without forethought and without discrimination, that

they become offensive. Wherever they are inoffensive, be sure they were designed, and designed with more than ordinary skill. It is only a master than can reconcile us to something which, until he did it, we did not think could properly be done. There is nothing careless or casual in the art of design—not even in the little art of ornament.

OXALIC ACID FOR THE SEPARATION OF VARIOUS METALS.

By C. LUCKOW.

If oxalic acid is added to the solutions of different common metals—neutral or faintly acid—there are produced in the majority of such solutions precipitates of insoluble or sparingly soluble oxalates. In a few cases only there takes place no separation of insoluble oxalates, and the solutions remain clear.

This latter case occurs in the solutions of the alkali metals and those of the higher compounds of some metals rich in electro-negative constituents, in which hydrated alkalies throw down hydrates corresponding to the sesqui- and peroxides, and in which such hydrates form compounds with a metallic acid. A precipitation of insoluble oxalates does not occur in the solutions of neutral salts of the alkaline metals, and in the solutions of chrome, aluminum, iron, manganese, uranium, and tin oxides, as well as of chromic, manganic, and antimonious acids, and of the acids of arsenic.

This behavior of the oxalates affords means not only of distinguishing the various stages of oxidation of the above acids, but also of separation, qualitatively and quantitatively, of the metals in question in their higher compounds from a great number of other metals. Setting aside gold and platinum, we find that among the metals of group VI. stannous oxide and antimony teroxide are separated from their solutions by oxalic acid, while no precipitation ensues in the solutions of stannic oxide, antimonious acid, and of the arsenic acids. All the metals of group V. are precipitated by oxalic acid.

The oxalates of lead, bismuth, silver, copper, and mercury, both in their maximum and minimum compounds, are almost insoluble. Cadmium oxalate is sparingly soluble. Copper, and indeed all other metals, should be thrown down only from hot liquids, preferably by a boiling solution of oxalic acid or by adding to the boiling solution a sufficiency of finely pulverized oxalic acid, as the precipitates in boiling solutions subside more rapidly. After the liquid has become clear it is filtered by decantation, so that the least possible quantity of the precipitate is brought upon the filter. The two portions of precipitate (that on the filter and that on the beaker) are then dried, placed in a porcelain crucible, and heated, very cautiously at first, and finally more strongly after the addition of a little nitric acid. Small quantities of copper oxide can be easily converted into oxide. Large quantities are inconvenient on account of the gases evolved during the decomposition of the oxalates, which may occasion loss by projection.

The silver salt enters into decomposition at 110°, and detonates if heated more strongly. The mercuric salt is decomposed at 163° somewhat violently into mercurous salt and carbonic acid. Instead of decomposing oxalic acid in its salts by heat alone, it may be destroyed by heating with strong sulphuric or phosphoric acid, with permanganic acid, chromic acid, or with chlorine in an alkaline solution.

As for the metals of group IV., oxalic acid throws down nickelous, cobaltous, manganous, ferrous, and uranous oxides, and also zinc oxide, from their neutral or moderately acid solutions as sparingly soluble oxalates. In this group, consequently, ferrous, manganous, and uranous oxides may be separated, by means of oxalic acid, from the corresponding higher oxides. The faintly rose-colored cobalt oxalate and the dull green nickel oxalate much resemble the copper salt in the fineness of the precipitates. Both are very sparingly soluble. Rather more soluble is the lemon yellow, very stable ferric oxalate, and the manganous salt, which is almost white and settles readily.

The zinc salt is most readily and completely separated by evaporating its solutions mixed with a slight excess of oxalic acid. This behavior of the zinc salt must be kept in mind in quantitative analyses. The complete separation of all the precipitates produced by oxalic acid is much promoted by the time allowed. The metals of group IV. require more time than those of group V. If to the solutions supersaturated with oxalic acid there is added a solution of ammonium chloride or nitrate, the separation of the insoluble oxalates is much promoted.

A rapid and complete separation of all these salts is effected by evaporating down the solution with a slight excess of oxalic acid, and taking up the soluble matters in a little water. A volatilization of volatile chlorides under these circumstances does not take place if oxalic acid is present in excess, even in case of arsenious compounds. Dilute sulphuric and nitric acids do not appreciably increase the solubility of oxalates which are insoluble in pure water and in dilute oxalic acid. Hydrochloric acid, even if dilute, has a decidedly solvent action. Similar is the action of strong oxalic acid upon various insoluble oxalates. Many of the insoluble oxalates combine with the alkaline oxalates to form soluble double salts. Exceptions are the strontium, barium, calcium, silver, lead, and mercurous salt. The lead and the mercuric salt dissolve in hot solutions of alkaline oxalates, but separate out again on cooling or dilution. The barium, magnesium, and mercuric salts are soluble in ammonium chloride. The non-volatility of the soluble oxalates is of importance, as evaporation is the quickest, simplest, and most certain method of separating the soluble compounds quantitatively from the insoluble. In such solutions the oxalic acid must be present in slight excess. If the evaporated residue is treated with water, the soluble oxalates are dissolved without decomposition, and may then be separated from the insoluble by filtration.

Ammonia produces no precipitates in the solutions of antimonious and antimonious acids, while precipitates of oxides or of basic salts are formed in the oxalic solutions of stannic, ferric, uranium, chromium, and aluminum oxides. Alkaline phosphates and borates, which, like ammonia, precipitate all these solutions in the absence of oxalic acid, occasion no deposits in its presence. This behavior of tin and antimony solutions with ammonia affords a simple means for the separation of

the two metals. Even in solutions containing both, the tin is thrown down free from antimony if the solution contains sufficient oxalic acid or ammonium oxalate, or if the precipitated tin oxide is dissolved in hydrochloric acid, mixed with oxalic acid, and reprecipitated with ammonia.

If we have to examine an alloy of tin, or antimony, or of both, with lead, copper, zinc, or iron, the comminuted sample is dissolved in a small excess of aqua regia, oxalic acid is added to the boiling solution so long as a precipitate is produced, the insoluble oxalates are allowed to settle on cooling, or the solution along with the precipitate is evaporated to dryness on the water-bath and taken up again in a little water. The separation of the precipitate from the liquid is best effected by decantation through a double filter, bringing upon the filter as little as possible of the precipitate. In quantitative operations the precipitate and the filter are freed from soluble portions by means of a dilute solution of oxalic acid, and both are then dried and cautiously ignited. In the solution are found the tin, iron, and antimony if its conversion into antimonious acid has been complete, and the arsenic as arsenious or arsenic acid. As various oxalates are not absolutely insoluble in water and dilute oxalic acid, traces of them may be found in the solution containing the tin, antimony, and iron, and must be considered in accurate quantitative operations.

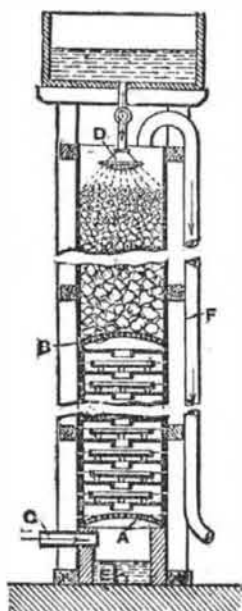
In the treatment of the ores, alloys, etc., with aqua regia, it is well, in case antimony is present in large quantity, to mix the solution, before adding the oxalic acid, with chlorine until a distinct and permanent odor of chlorine is perceptible, in order to make sure that all antimony is present as antimonious acid. In presence of zinc it is safest either to evaporate down the solution (after addition of oxalic acid) upon the water bath, or to allow the same oxalic solution, mixed with ammonium chloride or nitrate, to stand for some hours.

In order not to introduce an excess of acid, 0.1 gm. of the ore or alloy requires 1 c. c. aqua regia made up of 3 to 4 vols. hydrochloric acid, sp. gr. 1.2, and 1 vol. nitric acid of the same sp. gr., and that this 0.1 gm. requires twice the weight of crystalline oxalic acid (COOH_2) + aq. in order to convert all the dissolved metals into oxalates. If sparingly soluble chlorides or sulphates separate out in the solution, they may be transformed into the corresponding oxalates by boiling with a slight excess of oxalic acid.

If alloys containing tin are treated with nitric acid, the supernatant liquid evaporated to expel nitric acid, the residue or its insoluble portion moistened with a little hydrochloric acid, digested with a strong solution of oxalic acid until the hydrochloric acid is expelled, oxide is dissolved, while any metals present forming insoluble oxalates pass into the precipitate. Antimonious acid prepared with strong nitric acid does not possess this property, but the meta-antimonious acid formed by the action of water on antimony perchloride. Solutions of antimonious acid mixed with oxalic acid remain, therefore, clear on dilution with water. It is possible that this different behavior of tin oxide and antimonious acid may lead to a separation of the two metals.—*Zeitschrift Analyt. Chemie*, vol. xxvi., p. 9; *Chemical News*.

RECOVERY OF SULPHUROUS ACID.

A GERMAN patent, by E. Haenisch and M. Schroeder, furnishes a means for separating steam and sulphurous acid where both are given off simultaneously. Sulphurous acid is now largely used by paper makers, and it has been found difficult to deal with the mixture of steam and sulphurous acid which is evolved in the sulphite process. This mixture, besides being a nuisance, is also a source of loss, as regards heat and sulphurous acid, and an apparatus which will enable the manufacturer to recover both should prove of value. The above named inventors use a lead tower, which, in the lower half, A B, is filled with trays made

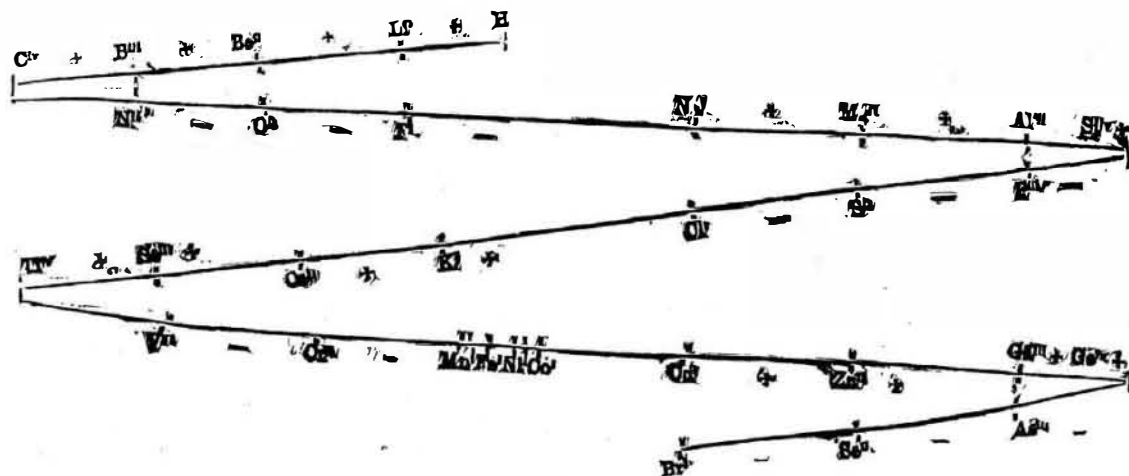


of fire clay. The rest of the tower is filled up with coke. The mixture of sulphurous acid and steam enters at the bottom through the pipe, C, and is met in its passage upward by a stream of cold water, which is supplied from the top by means of a distributing apparatus, D. Both steam and sulphurous acid become condensed, but on running down meet again the mixture of steam and sulphurous acid. The consequence is that the condensed solution of sulphurous acid becomes gradually heated up to 212° , at which temperature all the sulphurous acid is given off. After having worked for some time, the temperature of the condensing water should rise to 212° as it arrives at the bottom of the tower. It is there discharged by a pipe, E. The temperature of the sulphurous acid, on the other hand, should decrease to the temperature of the condensing water as it approaches the top of the tower. If the quantity of the condensing water is properly regulated, it will not be sufficient to condense

the quantity of sulphurous acid evolved, and a continuous current of sulphurous acid gas will, therefore, be obtained at the top of the tower, from which it is taken away by a pipe, F. We may here remark that in filling a tower with coke, great care should be observed. It is advisable to get good hard coke, and to pack the tower by hand, that is, to place the pieces of coke carefully, so that they should not be broken. The coke should be riddled, so that all the dust be removed, and the largest pieces placed at the bottom, then a layer of smaller pieces, and so on up to the top, where pieces of the size of a small apple may be put. This is the only way to avoid the stopping up of wash or condensing towers, and carelessness in this apparently paltry matter has more than once caused great trouble and expense.

GENESIS OF THE ELEMENTS.

NOTHING is so fascinating in science as an ingenious, but unproved, theory. Once proved to the dignity of a "law," it becomes a thing to be learnt, and exchanges the charm of an uncertain *denouement* for the cold severity of a lesson. The strange revelations of modern chemistry in relation to the nature of the so-called elements have kindled among all scientific students an intensely eager anticipation of the discovery of some simple scheme into which all the accumulated facts shall drop in natural connection, of the thread which links the myriad observations of patient explorers into a perfect chain. "We cannot but feel," said Mr. Crookes at the Royal Institution recently, "that unless some approach to an answer to these questions



can be found, our chemistry, after all, is something profoundly unsatisfactory. These elements perplex us in our researches, baffle us in our speculations, and haunt us in our very dreams. They stretch like an unknown sea before us, mocking, mystifying, and murmuring strange revelations and possibilities."

Mr. Crookes detailed his speculations on the genesis of the elements at the last meeting of the British Association, and we then reported his address in full. He has lately presented his ideas again in rather more popular language to the fashionable world of science assembled in Albemarle Street, and many of the keenest minds in England are pondering his theory.

A few weeks since, Sir William Thomson narrated to a similar audience his idea of the way in which the sun was formed some twenty millions of years since, by the rushing together of atoms in such quantity and with such force as to provide a source of heat for this solar system up to the present date and about ten million years longer.

Mr. Crookes takes us back a few steps farther. What was the condition before the atoms had themselves come into shape, if, indeed, they are not eternal, when creation was, in the expressive language of Scripture, "without form and void"? Mr. Crookes assumes a condition which he designates "protyle," the "proteule" of Aristotle, the formless stuff of the Book of Wisdom, the *materia prima*, the unknown and unknowable origin of matter, the "fire mist," as Mr. Crookes himself happily, but vaguely, terms it.

Now suppose in the midst of this protyle the introduction of external energy in some form or other, and an internal action corresponding to cooling. The energy has periods of swell and ebb, and it forces the protyle to shape itself and to develop first the lightest of atoms, say hydrogen. These atoms would then be themselves stores of energy, kinetic from their internal motions, and potential from their tendency to coalesce with other atoms by gravitation or chemically.

Each new formation would tend to the formation of others by refrigerating the surrounding protyle, and we should get sets of atoms of regular progressive weight. Now (without following Mr. Crookes in all the steps of his argument) see how these elements group themselves, and notice the regular ebb and flow of the formation.

It is not necessary to continue the diagram, which is a modification of one first drawn by Professor Emerson Reynolds. It will be found complete in this journal for September 25, 1886. What is to be noticed is this: When energy first acted on protyle, its first accomplishment was the formation of the hydrogen atom. A few thousands of years later it had got as far as lithium; next came beryllium, boron, and carbon. So far, positive elements only had been created in regular progression of atomic weight and of valency.

Now the pendulum returns, the ebb sets in, negative elements are formed until the center is reached, when a new impetus is given, and new creations result in similar order. As the pendulum reaches a corresponding stage in each swell or ebb, elements of curiously corresponding characteristics result. So we have chlorine, bromine, and iodine; calcium, strontium, and barium; arsenium, antimonium, and bismuth found at corresponding points of the pendulum's swing.

A great deal of this theory is due to the labors of other chemists—Newlands, Mills, and Mendeleef especially; but Mr. Crookes has, no doubt, most ingeniously fitted all their observations into his comprehensive scheme. His own special contribution to his theory, however, is very striking. He has worked for

many years on yttrium and its spectra. By the most delicate of tests he has shown that yttrium can be differentiated or fractionated into several varieties, all showing the true yttrium spectrum, but each with some marked differences of its own in the subordinate lines.

This observation is what led Mr. Crookes to imagine that the creation of yttrium was itself a work of time, of slow evolution, leaving its effects in trifling variations of the weight of the atoms, which altogether go to make up yttrium. If that be so, is it not possible too that the whole genesis of the elements is a very slow process of evolution? The occurrence of such groups as manganese, iron, nickel, and cobalt, with their curiously similar chemical properties, all created apparently at close intervals, goes to support this idea.

Much more will certainly be heard of this theory. We make no pretension of criticising it. Our design has been only to present its salient features in outline, leaving students who may wish to understand it more fully to refer to the eminent author's own words.—*Chemist and Druggist*.

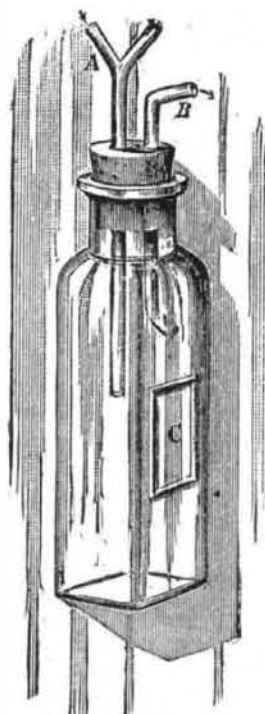
ORIENTING OBJECTS IN PARAFFINE.

IN the *Zool. Anz.*, No. 199, Selenka has described a method of keeping paraffine melted while the contained small objects are being arranged under the microscope in any desired position, and then of rapidly cooling the paraffine without disturbing the position of the objects.

Finding it difficult to make tubes such as he describes, which should be of such shape as to admit of

removing the hardened paraffine readily, and at the same time with depressions of sufficient size for any but very minute objects, I have made use of the following simple device, which, though more clumsy than the tube of Selenka, can be used for objects 1 mm. long, and much larger, while giving a block of paraffine of very regular shape and with rectangular sides.

A common flat medicine bottle is fitted with a cork through which two tubes pass, or if the mouth is small, one tube may be fastened into a hole drilled into the bottle. One of these tubes, A, is connected with hot and cold water; the other, B, is a discharge pipe for the water entering the bottle by A, and raising or lowering its temperature as warm or cold water is allowed to flow in. On the smooth, flat side of the bottle four pieces of glass rods or strips are cemented fast, so as to



inclose a rectangular space, C, which forms a receptacle for the melted paraffine. As long as the warm water circulates through the bottle the paraffine remains fluid, and objects in it may be arranged under the microscope by light from above or below, and can be oriented with reference to the sides of the paraffine receptacle or with reference to lines drawn upon the surface of the bottle.

When the cold water is allowed to enter in place of the warm, the paraffine congeals rapidly and may be easily removed as one piece. The discharge pipe should open near the upper surface of the bottle, to draw off any air which may accumulate there.—*E. A. Andrews*.

A VESSEL with a cargo of forty-four ostriches arrived recently at Galveston, Texas. This is the second cargo within twelve months. The birds are for ostrich farms in California, and came from Natal.