APID ESTIMATION OF PHOSPHORIC ACID, MAGNESIA, AND LIME.

I attack in the cold 30·86 grains of phosphate with 3 cubic inches of hydrochloric acid or weak nitric acid, and filter it. I take 0·3 cubic inch of this solution, add at first some citric acid, then ammonia in excess, and lastly precipitate by a solution of chloride of magnesium, the liquid being maintained ammoniacal.

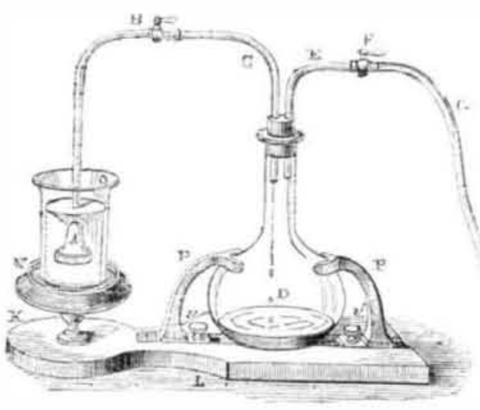
The phosphoric acid deposits in the form of ammonio-magnesian phosphate. By means of the exhausting filter I separate it from the supernatant liquid, wash it with ammoniacal water, exhaust again, and finally dissolve the precipitate, by means of some drops of nitric acid, and estimate volumetrically by means of acetate of uranium, according to M. Leconte's process, to which I have made several useful additions.

Thanks to my new apparatus, the union of the two methods is complete, and the quickness of the process is such that, in less than two hours, ten estimations, at the least, can be made. The estimation of phosphoric acid becomes as easy as that of nitrogen by soda-lime, while it is more general and not less accurate.

Suppose we have to analyze superphosphates of lime of commerce. The necessity of distinguishing phosphoric acid which is in the soluble state from that which is in the insoluble state requires two parallel attacks, one with distilled water and the other with weak nitric acid. The operation is always the same. We work on each liquid separately, as I have just pointed out in the case of natural phosphates.

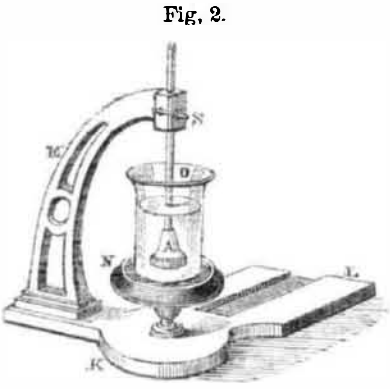
I will now describe the apparatus that has so much expedited the work. A glance at the drawing is sufficient to understand their arrangement and mode of action (Fig. 1). An exhaustion is formed, equal to a very few inches of mercury, in the globe, D, by the help of a small hand pump. The base of the cone, A, covered with one or two disks of blotting paper, held in place by a ring fitting tightly by friction, works as a true filter, which acts under pressure.

Fig. 1.



I have adopted two forms of apparatus, one of platinum and the other of glass (Fig. 2). The fragility of the latter is obviated by means of the consolidation arm, M, which firmly fixes the exhausting tube.

Fig. 2.



The facility which this method gives of multiplying estimations has led me to define, experimentally, all the conditions which could affect the precipitation of the ammonio-magnesian phosphate. Among other results, I have discovered a means of rendering the precipitation almost instantaneous. To effect this, it is necessary to operate on a moderate quantity of phosphate, and to employ an excess of chloride of magnesium. With a small quantity of chloride the precipitation is slow, with more it is quicker, with an excess it is immediate. After waiting a quarter of an hour, we may proceed with the estimation of phosphoric acid, only the filtration takes a little longer; after an hour the result is perfect.

An excess of citrate of ammonia holds in solution very appreciable quantities of ammonio-magnesian phosphate; the loss, however, which results from it is very slight.

Citrate of lime dissolves nearly three times more ammonio-magnesian phosphate than citrate of ammonia. The intervention of 1 grain of lime has sufficed, in fact, to raise the loss of phosphoric acid from 0·033 to 0·066 of a grain; but I have ascertained that an excess of chloride of magnesium, so efficacious in hastening the precipitation of the ammonio-magnesian phosphate, completely neutralizes the solvent action of the citrates of lime and ammonia, and confers on the results both accuracy and concordance.

I have studied the precipitation of phosphoric acid in the presence of lime and aluminum, separately at first, then associated with lime; and I have arrived at the conclusion that, by keeping the quantities of citric acid, of chloride of magnesium, and of ammonia, and of the total volume of the liquid between certain limits which I point out, the process is of irreproachable accuracy.

Whether we are working with natural phosphates or with commercial superphosphates; whether the product contains sulphuric acid or is free from it; whether the proportions of alumina, oxide of iron, and lime are great or small; the indications of the process are always exact and concordant.

The method possesses the two characteristics of accuracy and swiftness, and a degree of generality which renders it applicable in every case which may interest physiology, industry, and agriculture.—*M. G. Ville, in Chemical News.*

Correspondence.

How to Line Shafting.

To the Editor of the Scientific American:

I noticed in your issue of November 28, J. F.'s query as to the best way to keep shafting in line. This is an important matter, as much waste of power is caused by working ill adjusted shafting. Every one operating long lines of shafting should provide an adjusting rod, as shown in the engraving. A may be a rod of wood or a piece of gas pipe, of sufficient length to reach from the shaft, O, to within about four feet of the floor; an offset piece, B, is fixed to the top of this rod, which carries a right and left hand screw, C; two jaws, D, travel upon this screw, one upon the right and the other upon the left hand thread, as shown. The screw may be worked by a ¼ inch wire, E, with a crank, F, at its lower end; if a gas pipe is used, the wire may pass through the pipe, and the lower end of the screw, C, enter the top of the pipe as a bearing. If the rod, A, is of wood, three or four wire staples will suffice as guides for the wire, as indicated. A target, G, with a clamp screw, slides upon the rod, for the purpose of easy adjustment to the sights of the leveling instrument.

Now it will of course be apparent to every one that, whenever several sizes of shafting occur in the same line, this adjusting rod will always give the exact central distance, O, of the shaft from the target; hence we have only to plant the leveling instrument in a position to command a view of the target when suspended from each of the several bearings of a line of shafting, in order to adjust the level of a line with the utmost expedition and accuracy. An engineer's tripod and level is of course the best instrument for this purpose, but, when this is not at hand, an ordinary builder's level may be used: the longer it is, the better. Fix a temporary sight at end of the level; a piece of tin (with a small pin hole) next the eye, and a piece of tin or thin wood with a large hole at the farther end, with a vertical and a horizontal thread stretched across the hole, with their point of intersection the same distance above the level as the hole in the eye piece. The level may be used upon a level stand or table, some five feet from the floor.

To adjust a line of shafting laterally, the adjusting rod must of course be used horizontally in connection with a strong line, stretched as taut as possible, at such distance from the shafting as to need nearly the full length of the rod to reach it. The reason for placing the line at such a distance from the shaft is to prevent the difference in level between the line and the shaft from materially impairing the truth of the result. If the line is very long, it will sag so much that a plumb line suspended from the measuring point of the target or rod may be necessary for perfect accuracy.

The jaws, D, should be so formed that they may be applied to the inside of boxes. Pivot boxes are now so generally used, however, that this application of the rod is not so common. F. G. WOODWARD.

Curious Apples.

To the Editor of the Scientific American:

Your correspondent Fletcher Williams, in his attempted explanation of the curious apple mystery, advances a novel theory which, I think, will interest pomologists.

This is the first time I have ever heard that sweet apples were sour when unripe, or sour apples sweet in a green state; and I cannot fully understand which was the "abnormal growth" he speaks of. Was it the sweet or sour part of the apple? I know all about that tree of Dr. Ely's, in Monson, having myself picked many bushels of fruit from it, each of the apples being partly sour and partly sweet. As you observe: "The sweet was very sweet, and the sour very sour." The flavor of each was excellent, and the apple well developed and fully grown. The color of the sweet part was a bright lemon, and of the sour part a green, like the Rhode Island greening. I have kept many specimens until they decayed, no change different from any other apple appearing. There was no "suture" between the sweet and sour parts other than the difference in color, which was usually in a straight line and very marked. One part of the apple was no more fully developed than the other.

Probably your correspondent never saw such apples, and his explanation has as little to do with the case mentioned as it has in explaining why some apples are red and others green in color, when both are ripe. Dr. Ely grafted the tree himself, and was not aware that the process was in any way different from many others he had grafted. He simply grafted a sweet apple scion on a tree that bore sour apples, and the fruit was as I have stated. The fruit, however, after a few years deteriorated, and became altogether sour and of a poor quality. Would not the best plan be to leave it as a *lusus naturæ*, and not attempt to explain it by assuming a more wonderful condition of things? E.

New York city.

Our Lighthouses.

The annual report of the Lighthouse Board says.

The magnitude of the lighthouse system of the United States may be inferred from the following facts:

1st. The coast, from the St. Croix river on the boundary of Maine to the Rio Grande on the Gulf of Mexico, includes a distance of 5,000 miles.

2d. The Pacific coast has a length of about 1,500 miles.

3d. The great northern lakes, about 3,000 miles.

4th. The inland rivers, of 700 miles, making a total of more than 10,000 miles.

The following table exhibits a synopsis of what has been accomplished in aid of navigation along these standard lines, by far longer than those of any other nation in the world:

Lighthouses and lighted beacons, 608; lighthouses and lighted beacons finished and lighted during the year ending July 1, 1874, 25; lightships in position, 21; fog signals operated by steam or hot air engines, 40; day or unlighted beacons, 346; buoys in position, 2,865.

The board do not deem it expedient to attempt to introduce the electric light, or that of gas, on account of the complexity and cost of the apparatus. It is their intention, however, to adopt any improvements in the lamps, of the importance of which they are assured by the results of photometric experiment.

The recent introduction of an improved wick has increased the capacity of their lamps of the first order to the amount of a hundred candles. This, however, is at a proportionately increased expense, on account of the oil consumed.

As to fog signals, the coast of no other country is so subject to fogs as that of some parts of the United States. On this account, fog signals in many places are almost as necessary as lighthouses. But abundant experience has shown that a sound of sufficient magnitude to become an efficient aid to navigation can only be produced by a large amount of power derived from steam or heated air and applied by means of complex machinery, expensive in first cost and in continued maintenance. Improvements are about to be introduced in regard to the fog signals, which, while they will greatly increase the range to which the sound may be heard, will of necessity increase the cost of their maintenance.

The New Laboratory at Oxford.

The building consists principally of three floors, and is surmounted by a tower of fifty-nine feet in hight, and contains twenty-six large rooms and numerous apartments, each specially adapted and devoted to experiments in certain departments of physical science. In the magnetic room is placed the great electro-dynamometer of the British Association. The room used for the experiments in heat at present contains an apparatus devised by Professor Maxwell for determining the viscosity of air. The galvanic battery is connected by properly insulated wires with the lecture room and other portions of the building. The battery which will be employed is, of course, confined in a room fitted expressly thereto, and is of the style known as Sir William Thomson's tray battery. The lecture room will afford accommodation for about one hundred and eighty students, the seats for the class rising at an angle of about thirty degrees, and three doors providing sufficient means of egress for the audience. In the room allotted to experiments in electricity of high tension, an apparatus contrived by Mr. Latimer Clark has been introduced, for the purpose of keeping the air of the room dry. This consists of a heated copper roller, over which passes an endless band of flannel. The roller is heated by means of gas lights within it, by which, being constantly burning, every part of the flannel becomes hot. The vapor which arises from the heated flannel is carried off by the current of air which supplies the burners inside the roller. The flannel, when thus dried and cooled, passes into the open air of the room, where it again absorbs moisture, and thus the air of the room becomes so dry that the electrical instruments are preserved in a highly insulating condition. The electricity passes from the electrical machine to the table in the lecture room by insulated wires connected with the prime conductor of the machine. The highest room in the building occupies the upper portion of the tower. In this room will be placed a Bunsen's water-pump, the water from which will thus have a vertical fall of considerably more than fifty feet. This pump will be used to exhaust a large receiver, from which pipes will communicate with the different rooms; so that, if it be desired to exhaust the air from any vessel, it will only be necessary to connect it with one of these pipes, and turn on a vacuum. For a more perfect exhaustion, the Sprengel or other air pump can be employed. On the top of the tower will be fixed a wooden mast, carrying a pointed metal rod, for the purpose of collecting atmospheric electricity.

DR. A WYNTER BLYTH, medical officer of health to the county of Devon, Eng., has made a series of experiments which show that water containing organic substances is purified by running through iron pipes.

As an inducement to provide safety precautions, a reward of $2,000 is to be given to that colliery owner in Belgium in whose pits the smallest number of workmen shall have been killed by explosions in the ten years ending in 1883.

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