

lished papyrus preserved in the British Museum, containing medical prescriptions written in the Egyptian hieratic writing of the nineteenth dynasty (B. C. 1400-1200), and chiefly interesting from the fact that it contains prescriptions copied from an earlier work, now lost, which is said by the ancient copyist to have dated from the fourth dynasty (circa B. C. 4000—before the flood). It seemed strange amid these relics of the oldest known civilization to hear the sound of the cornet wafted from the next room from one of Edison's phonographs! What will the people of 5,000 years hence make of the phonograph cylinder should they find one? Will it be as deep a mystery to them as the papyrus was to every one at the *conversazione*? Needless to say, the phonograph was a great attraction, and so were the photographs showing the formation of drops, which were exhibited by Mr. C. V. Boys, F. R. S., along with a thaumatrope, which is a circular disk, upon which the forms of the drop at minute intervals from the start to the finish are placed, so that when the disk is revolved the observer sees the gradual formation of the drop and the spherule, the oscillation of the pendent drop immediately afterward, the rebound of the spherule from the pendent drop, the oscillation of the large drop as it falls, and its rebound from the water below into which it fell.

CHEMICAL CONSTITUENTS OF APPLES.

In the recently issued *Bulletin of the Missouri (Columbia), Department of Horticulture*, an interesting article is given by Professor J. W. Clark on the chemical analysis of apples of the variety Ben Davis, in order, as stated, to place before fruit growers in a concise and practical manner the ash analysis of apples in their different stages of development, that the importance of thinning the fruit early and letting only the perfect specimens ripen might be made plain to all.

Three samples of the fruit were taken, as follows:

1. Made up of green, immature apples picked from the tree July 9, and averaging $1\frac{1}{2}$ in. in diameter.
2. Taken October 23, and composed of large and perfect fruit, averaging $3\frac{1}{2}$ in. in diameter.
3. Also taken October 23, and made up of small and imperfectly formed apples, which averaged $2\frac{1}{2}$ in. in diameter.

ANALYSIS OF BEN DAVIS APPLES IN THREE STAGES OF GROWTH. ACTUAL QUANTITIES, AND PROPORTIONS PER CENT.

	Unripe Apples.	Ripe Apples.	Small Apples.
	July 9.	Oct. 23.	Oct. 23.
	Grains.	Grains.	Grains.
Average weight of whole fruit.	47.7	215.0	70.4
Weight of flesh in fruit.	201.0	61.7	
Weight of core in fruit.	14.0	8.7	
Weight of ash in fruit.	5.51	4.13	4.81
	Per cent.	Per cent.	Per cent.
Amount of flesh in fruit.	93.4	87.6	
Amount of core in fruit.	6.6	12.4	
Ash in whole apples.	0.29	0.27	0.34
Carbon in same.	2.35	6.04	0.52

From the foregoing data we learn that a large proportion of the mineral matter (ash) contained in the apple is stored up during the early part of its growth, for, comparing the percentage of ash in the apples collected July 9 with those of the ripe fruit collected October 23, we find the largest amount in those earliest gathered.

The ripe apples are seen to contain two and one-half times as much carbon as the unripe ones; the small, imperfectly formed fruit containing quite an immaterial amount of carbon, scarcely more than one-half per cent.

The following table shows the analysis of the ashes of apples at different stages of growth, the quantities of the various ingredients being given in parts per 100, and calculated in ounces in 10 bushels or 500 lb. of apples:

MINERAL CONSTITUENTS IN BEN DAVIS APPLES IN THREE DIFFERENT STAGES OF GROWTH. PERCENTAGE QUANTITIES AND ACTUAL QUANTITIES IN TEN BUSHELS OF FRUIT.

	Unripe Apples.		Ripe Apples.		Small Apples.	
	July 9.		Oct. 23.		Oct. 23.	
	Per ct.	Oz.	Per ct.	Oz.	Per ct.	Oz.
Silica.	0.58	0.13	1.23	0.26	2.16	0.59
Ferric oxide.	0.47	0.11	0.46	0.11	0.66	0.18
Phosphoric acid.	8.96	2.07	8.20	2.23	8.73	2.39
Lime.	6.85	1.58	5.66	1.21	8.85	2.42
Magnesia.	4.80	1.11	4.30	0.92	4.76	1.30
Potash.	54.02	12.49	56.74	12.12	52.44	14.35
Soda.	2.10	0.49	1.94	0.41	2.08	0.57
Undetermined.	22.22	5.14	21.47	4.50	20.62	5.56
Total.	100.00	23.12	100.00	21.76	100.00	27.36

The only ingredients contained in the ash which there is any need of noting are the phosphoric acid, potash, and lime; for these are the only ones in which the soil is likely to become deficient, and, therefore, that need to be returned to the land to keep up its fertility.

From the above analysis we find there would be taken from an acre of land set with apple trees, 30 ft. apart, and yielding 10 bushels of fruit to the tree, by sample No. 1, 6 lb. of phosphoric acid, $37\frac{1}{2}$ lb. of potash, and $4\frac{3}{4}$ lb. of lime; by sample No. 2, 7 lb. phosphoric acid, 37 lb. potash, and $3\frac{1}{2}$ lb. of lime; by sample No. 3, $7\frac{1}{4}$ lb. of phosphoric acid, 43 lb. of potash, and $7\frac{1}{4}$ lb. of lime.

From these facts we learn the importance of thinning fruit as soon as it is of sufficient size to show the wormy and imperfect specimens, and also that it costs

less to grow a bushel of large and perfect apples than it does to grow a bushel of small and inferior fruit.

It is further evident that to produce good crops of apples for any number of years, the ground, when the trees are planted, must have phosphoric acid, potash, and lime returned to it if we wish to keep up production and fertility of the soil.

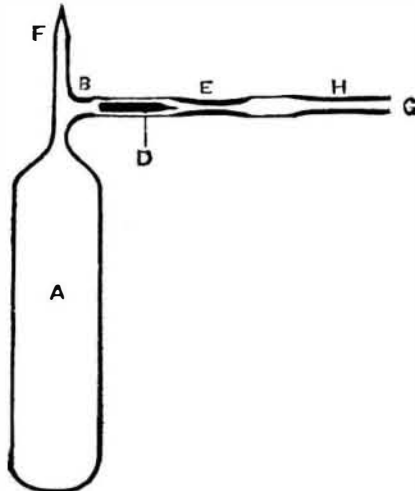
The cheapest and most available source of obtaining these substances, and applying them to the land, would in most cases be from ground bones, muriate of potash, kainit salts, superphosphate, or wood ashes.—*J. J. Willis, Harpenden.*

SEALING TUBES UNDER PRESSURE.

By A. RICHARDSON.

In experimenting with gases under pressure I have found it necessary to seal tubes hermetically after gases have been admitted under pressure. In order to do this the following arrangement was employed with complete success:

The experimental tube, A, is joined to a T-piece, B, the lateral limb of which is constricted as shown in the figure; a glass plug, D, is ground into the tube at E, and serves the purpose of a valve opening inward. When gas under pressure is allowed to enter the tube at G the valve opens, but on removing the pressure



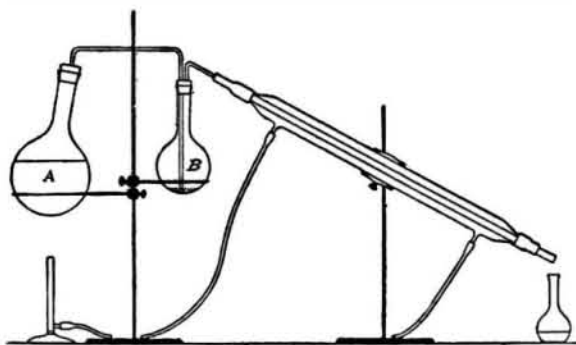
from without, it at once closes: the escape of gas from A is thus prevented, and the tube may be sealed before the blowpipe at H. When the tube contains a liquid the plug should be moistened with it; this will prevent the escape of gas while the tube is being sealed, even though the plug does not fit very accurately; in the absence of any liquid greater care in grinding the plug is required. The tube, F, serves for the admission of liquid into the experimental tube in the first instance; it is then closed, and at the end of the experiment it is opened and the contents of the tube removed. The rest of the apparatus is thus kept intact, and may be used repeatedly, especially if the tube at H is fairly long.—*Chemical News.*

APPARATUS FOR THE DETERMINATION OF AMMONIAS IN SAND AND SEWAGE.

By ALLEN HAZEN.

In examining sand from filters it has been thought desirable to determine free and albuminoid ammonia, as this shows the amount of organic matter stored, in the same terms as it is given for the filtered water or sewage.

To accomplish this, the apparatus shown by the figure has been used during the last two years. A liter flask, A, filled with ammonia-free water, serves simply to supply steam. A small glass tube carries the steam to the bottom of the small flask, B, which contains the sand. The steam passing through the sand very rapidly removes all free ammonia. Alkaline permanganate solution is then put in B, and the distilla-



tion continued. The albuminoid ammonia is given off much more rapidly than in the ordinary water distillation, owing to the concentration of the permanganate, which is put upon the sand full strength, while in water analysis it is diluted to eight or ten times its volume by the water. One portion of 50 c. c. invariably contains all the free ammonia. The first portion of albuminoid ammonia, when boiling rapidly, usually contains at least eight or nine tenths of the whole, and the second portion has almost all of the rest, so that only two tubes need be collected. Bumping is impossible. The condensation of steam in the small flask is not excessive, but if necessary it may be heated with a low flame.

I have found this apparatus to be well adapted to the examination of sewage and anything which contains enough ammonia. The great bulk of pure water which it would be necessary to use prevents its application to ordinary water analysis.

The amount of free ammonia thus obtained is the same as that found by the usual process of dilution with pure water and direct distillation. The albuminoid ammonia is commonly a little greater, owing to the concentration of the permanganate, but the results are sharper and different determinations agree

with each other more closely. There is also a very considerable saving of time when a number of determinations are to be made.

I prefer to use rubber stoppers and connections. It requires considerable boiling to get new rubber entirely free from ammonia, but once free there is no more trouble, and a stopper will last for a very long time.

Lawrence Experiment Station,
Massachusetts State Board of Health.

—*Amer. Chem. Jour.*

A NEW METHOD FOR THE ANALYSIS OF ZINC AND COPPER ALLOYS.

By H. N. WARREN, Research Analyst.

THE following method of separation of zinc from copper and other allied metals, which was introduced by the author at the commencement of the present year, and is now being satisfactorily worked in several commercial laboratories, depends chiefly upon the superior affinity of magnesium to replace not only copper and metals of the same group, but by suitable means to effect a complete separation of such oxidizable metals as zinc, iron, etc. The method, although speedy and accurate, is perhaps better suited in cases where an approximate idea is known as to the nature of the alloy qualitatively. In the case of the sample presented being a brass alloy, which should, for convenience sake, be obtained in the form of filings, a suitable weighed quantity is introduced into a small conical flask, to which is added strong H_2SO_4 in proportion to the quantity of sample taken. On applying a gentle heat from a sand bath for a few minutes the alloy is quickly rendered soluble, and the whole diluted with water to a convenient bulk.

A few coils of magnesium tape are now introduced into the solution and the solution maintained at about $100^\circ F.$ until the whole of the copper is precipitated, which is ascertained by the absence of a red precipitate upon the addition of a drop of potassium sulphocyanide to the filtrate. The precipitated copper, which should be of a perfect red color, is filtered and finally washed into a tared platinum dish by the aid of a small quantity of ether, and dried in the air bath, from whence the weight is readily obtained by the usual method. If tin, antimony, or other metals of the same group are suspected, the copper must necessarily be further examined.

To the filtrate is added a somewhat strong solution of sodium acetate, and the whole raised to the boiling point; by this means any free sulphuric acid is neutralized, all the iron that may be present is precipitated as tribasic acetate, and the sulphate of zinc present converted into acetate. Into this is introduced a further quantity of magnesium, and, in this instance, the form of thick sheet or rod is better adapted than that of tape, the precipitated zinc being the more readily detached from the same. Upon the introduction of the magnesium a brisk reaction follows, accompanied by a copious supply of hydrogen, the zinc being entirely precipitated, inasmuch that not the slightest precipitate is obtained on the addition of ammonia and ammonia sulphide to the filtrate, the zinc thus obtained being treated as in the former instance, which, if successfully performed, shows very slight signs of oxidizing.—*Chem. News.*

HYDRIDE OF PHOSPHORUS.

A PAPER upon the spontaneous inflammable liquid hydride of phosphorus, P_2H_4 , is communicated by Drs. Gattermann and Haussknecht, of Heidelberg, to the new number of the *Berichte* (p. 1174). Owing to the disagreeable and highly dangerous properties of this substance, its chemical history has never been completed; very little, indeed, has been hitherto added to our knowledge concerning it since its discovery by Thenard in 1845. The Heidelberg chemists have devised a much better mode of preparing the liquid from phosphide of calcium, by means of which it is obtained in a state of almost perfect purity. A Woulfe's bottle with three necks and of about two liters capacity is three parts filled with water. The central tubulus serves to introduce a wide tube of 15 mm. diameter expanded into a funnel at the top and passing down to about three centimeters beneath the water. One of the side necks is fitted with a cork and a bent tube just dipping beneath the surface of the water, through which a current of hydrogen gas can be driven. The third tubulus carries the delivery tube which permits of the escape of first the hydrogen, and afterward the products of the reaction between the calcium phosphide and the water into a special form of condensing arrangement. The Woulfe's bottle is placed in a capacious water bath, which is heated to $60^\circ C.$ as soon as all the air is expelled by the current of hydrogen. The calcium phosphide is then introduced through the central wide tube in pieces about two grammes in weight, until in about 15 to 20 minutes' time upward of 50 grammes have been added. The escaping gases pass first through an empty wide test tube in which most of the admixed water vapor is condensed, then into an upright tube, narrowed in its lower half, and closed at the bottom, which forms a suitable receptacle for the liquid hydride. By means of an exit tube the remaining gases are permitted to escape; owing to a little admixed and uncondensed vapor of the liquid, they burn spontaneously at the mouth of the tube. The condenser is surrounded with iced water instead of a freezing mixture, so that the condensation may be observed. In about five minutes after commencing the operation clear, colorless, highly refractive drops of the liquid form and run down into the narrower portion of the condenser, about 2 c. c. being obtained from 50 grammes calcium phosphide. The experiment must not be performed in sunlight, otherwise the liquid rapidly decomposes, in the manner described by Thenard, into gaseous PH_3 and solid P_2H_4 . By a slight addition to the above arrangement, all three hydrides of phosphorus may be simultaneously prepared. The escaping gases are allowed to pass through a large flask containing hydrochloric acid, which decomposes the vapor of the remaining liquid hydride, and large quantities of the yellow solid, P_2H_4 , separate out. The escaping gas, which may be collected over water, is non-spontaneously inflammable, and consists of practically pure PH_3 . Liquid P_2H_4 boils constantly and without decomposition when not suddenly heated at $58^\circ C.$ under a pressure of 763 mm. Its specific gra-