

The moisture is estimated first by drying it over chloride of calcium. Sulphuric acid should not be used in the desiccator, as it may spatter and cause an explosion. The explosive may be extracted in a closed funnel on a dried and weighed filter, or in a continuous extracting apparatus on such a filter. In the former case care must be taken that the volatile liquid does not rise too high on the sides of the vessel and cause loss of nitroglycerine. The ethereal extract is put in a small weighed beaker, and evaporated on a water bath at a very gentle heat. During the evaporation at a certain point the liquid gets milky as the nitroglycerine begins to separate. From now on, the operation must be watched, and as soon as the turbidity vanishes again, the beaker must be immediately removed from the water-bath. The nitroglycerine still contains a little ether or acetic ether. To remove these and traces of water it is dried in an air-pump receiver over chloride of calcium. The nitroglycerine can be weighed as pure when it has no more smell of ether, acetic ether, etc., and there is no perceptible difference in two successive weighings. If it contains other substances, like paraffine, rosin, and sulphur, which are soluble in ether, they are extracted along with the nitroglycerine, but to avoid using too much ether and a consequent loss of nitroglycerine in evaporating it, apparatus for continual extraction are used. After the ether evaporates the residue is dried and weighed, then warmed with soda lye on the water-bath. The rosin is dissolved and can be removed by decanting and washing with distilled water. It is precipitated again with hydrochloric acid, collected on a tared filter, washed, dried at 100° C., and weighed. Then the nitroglycerine is taken up with strong alcohol, decanted, and the residue of paraffine and sulphur rinsed with strong alcohol, dried, and weighed. To separate the sulphur and paraffine the mixture is warmed with an aqueous solution of ammonium sulphide, allowed to cool, the film of paraffine broken through, solution decanted, and paraffine washed, dried, and weighed—the quantity of nitroglycerine and of sulphur found by difference. In gelatinous explosives which contain mono or dinitro-cellulose, the extraction with ether will go on very slowly, because the dissolving of the nitroglycerine leaves a pellicle of collodion which protects the rest from solution. In this case it is better to extract both cotton and nitroglycerine at the same time with alcohol and ether, and then precipitate the cotton with chloroform. If camphor is also present, which can only be added to a few of the gelatinous ones, it must be extracted with carbon disulphide from the residue, freed from ether and chloroform. Camphor has never yet been found in the same mixture with paraffine, sulphur, or rosin. If they should be present all together they would be extracted along with the camphor by the disulphide, and can be separated from the others by its volatility. In the residue, after extraction with ether, or alcohol and ether, there may be trinitro-cellulose, or any one or more of the other substances already mentioned. If the qualitative analysis showed that the residue consisted only of mineral substances, it can be burned with the filter and weighed. It is better, however, to dry it first in a current of air at 60° C. (140° Fahr.), and weigh it and then burn it, and thus ascertain if there is not a little organic matter left in the residue: If there are any soluble salts in it they can be extracted with hot water after the weight of the dry residue has been found, and by evaporating their solution and drying at 120° C. their total weight is taken along with any extractive matter also present. If there are any carbonates, but no chlorates, the dry salts are dissolved in water neutralized with nitric acid, and evaporated on a water-bath, dried at 120° C. and weighed again. The carbonates are converted into nitrates, and the amount of carbonic acid calculated from the difference in weight. If the mass is ignited, then moistened when cold with nitric acid, and freed from the excess of acid, the salts will be converted into nitrates, but the extractive matter destroyed.

If, however, there are chlorates present, part of the salt must be ignited to convert them into chlorides and then estimated as chlorides of silver, the carbonic acid having been estimated by precipitation with nitrate of lime. The nitric acid can be estimated in another portion of the extract by conversion into ammonia. After estimating the bases in a separate portion, the extractive can be found by difference.

The residue insoluble in water is treated as follows: If it contains trinitrocellulose, a portion is removed from the filter and boiled with quite a concentrated solution of sodium sulphide, which dissolves the nitrocellulose; the rest is collected on a weighed filter, washed carefully with distilled water, dried, and weighed. The loss of weight gives the proportion of nitrocellulose in the part taken, and is calculated to the whole. After the trinitrocellulose is removed, or if there is none there, the rest is treated with dilute hydrochloric acid to remove any carbonate of lime or magnesia (also alumina), and these bases estimated in the solution. The residue is washed, dried, and weighed. This residue contains the wood, charcoal, or similar organic substances, and the insoluble mineral absorbents. The organic constituents are removed by burning, and the insoluble mineral matter weighed, and eventually separated and estimated in the usual way. If there is more than one organic absorbent used, as wood fiber and charcoal, there is no satisfactory method for separating them, and we must be satisfied with an elementary analysis, and judge of the substances by the relative proportions of carbon and hydrogen.

As a rule it is necessary to separate the proximate constituents. It is only in those dynamites that contain no other substance beside nitroglycerine that would affect its estimation, like Nobel's infusorial dynamite, in which a nitrogen determination can be made as proposed by Hempel, and a commercial valuation based on it, expressed in the calculated quantity of trinitrine. Although there is no longer much variation in the properties of the "oil," it has been found from the experiments made by a military commission that even in so simple a form of dynamite as Nobel's, the explosive value does not always increase and decrease in the same proportion as the percentage of nitroglycerine. The physical relations play a part in the simplest dynamites as well as the chemical composition. Among these are the more or less perfect absorption of the oil by the absorbent, from the adhesion of the particles together, on the elasticity of the preparation (in those containing gelatine), and on other similar circumstances. A nitroglycerine explosive of correct theoretical composition will be more or less completely used up by detonation, and its true effect more or less perfectly developed, in proportion as it is in the proper physical condition. Indeed, under certain circumstances a dynamite that is poor in nitroglycerine will produce more effect in the same medium than a fatter one having otherwise the same composition. To determine the explosive value of a dynamite in this respect, and thereby establish its commercial value, the chemical analysis must be supplemented by suitable means of ascertaining, by direct experiments on a

small scale, the explosive value of the preparation in practical use.

Hempel's method of estimating nitroglycerine, above referred to, consists in shaking a mixture of dynamite and sulphuric acid with mercury and measuring the volume of nitric oxide evolved. If nitrates, carbonates, and nitro-cellulose are present, the separation of nitroglycerine may first be made by the process above described so as to avoid error.

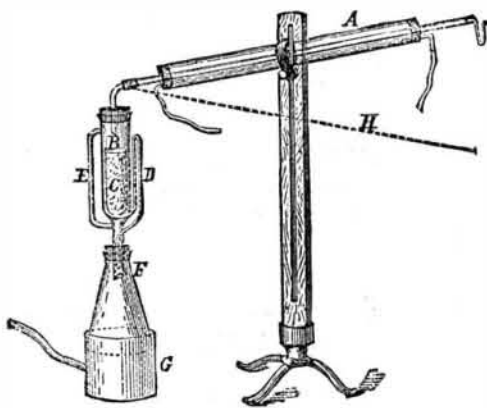
APPARATUS FOR THE ESTIMATION OF SULPHUR IN SPENT OXIDE.

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I HAVE lately been using for estimating the sulphur in spent oxide an apparatus which I have found very convenient. It is shown in the annexed illustration, and a description of it, together with an account of the mode of using it, may possibly be of interest to some of the readers of the *Journal*.

Referring to the diagram, B is a Hoxeth's fat extraction tube, fitted by caoutchouc stoppers at its lower extremity to a 10 oz. flask, F, and at its upper extremity to the condenser, A, by means of a bent glass tube, with flexible rubber joint. The condenser should be about two feet in length. G is a small circular tin vessel provided with an annular rim on the inside about an inch down, on which the bottom of the flask, F, rests. In using the apparatus, the charge of oxide, which may be from 100 to 200 grains, is placed in the tube, C, which is simply a short piece of ordinary test-tube, the bottom of which is contracted without being sealed. To charge this tube, the bottom is loosely plugged with tow, the weighed quantity of oxide then introduced, followed by a further plug of tow, leaving a small space unfilled at the top of the tube. The tube with its charge of oxide is then placed in the Hoxeth's tube, B, and four or five ounces of carbon disulphide poured in. The liquid will flow into the flask, F, by the siphon, D. The caoutchouc stopper of the Hoxeth tube, B, is then inserted (connection being thus made to the condenser), and the apparatus is ready for use.

On sending a current of steam from a flask of boiling water, or from some other source, into the tin vessel, G, the carbon disulphide soon boils, and the vapor passes up the tube, E, and becoming condensed on passing into A, the condensed liquid runs back, falling in drops into and filtering through the oxide in C. After a short time the tube, B, becomes filled up to the level of the top of the siphon, D, which then starts into action the solution of sulphur which has been formed, running into the flask, F. This ac-



tion of filling and discharging continues automatically until the whole of the sulphur has been transferred from the oxide to the carbon disulphide in the flask, F. The fact of the extraction being complete may be known by the liquid which periodically siphons off being practically colorless. By lowering the condenser, A, into the position shown by the dotted line, H, the carbon disulphide may now be distilled off, leaving the sulphur in the flask, F, in the solid state; the final drying being accomplished in a current of warm air or in the air bath. If the weight of the flask, F, is known, the increase in weight after the completion of the experiment gives the amount of sulphur. The small bent tube at the end of the condenser is for the purpose of preventing the escape of the heavy carbon disulphide vapor during distillation, at the same time that the liquid has a free exit.

The great convenience of this apparatus lies in its requiring so little attention. The extraction of the sulphur takes place completely and automatically, and the operator is enabled to devote himself to other work while the sulphur estimation is progressing.—*The Journal of Gas Lighting*.

ASBESTOS.

ASBESTOS is a mineral having a texture more or less fibrous, and by trituration is reducible to a somewhat fibrous powder. It is commonly divided into four varieties.

1. *Amianthus* or *Mountain Flax*.—The usual color of this mineral is greenish white, passing into leek green; or silver white, yellowish white, ochre yellow, pale flesh red, and, very rarely, light blue. It is found sometimes in small separate bundles, but more usually in irregular fibrous masses. Its luster is glimmering or slightly shining, and is either weak, pearly, or silky. It is easily divisible into long slender flexible fibers, may be scratched by the nail, and has a soft somewhat greasy feel. It is generally opaque, but is sometimes translucent on the edges. Its specific gravity is subject to great variety; that of the most flexible and perfectly fibrous is only 0.908; that of the most compact is 2.313. According to an analysis of this mineral by Chenevix, it appears to contain: 25 magnesia; 59 silice; 3 alumina; 9.25 lime, and 2.25 oxide of iron.

Before the blowpipe amianthus melts with some difficulty into an opaque globule, which becomes dark colored by the continued action of the flame. If exposed to a high heat in an earthen crucible, it melts into a dense slag, strongly adhering to the vessel and of a yellowish gray color; the surface of this slag is overspread with crystalline needles, crossing each other in all directions, or radiating from a common center. If the heat is considerably increased, the whole melts into a green glass and in a short time passes through the crucible. A specimen of amianthus from Greenland, being inclosed by Klaproth in a charcoal crucible and exposed to the full heat of a porcelain furnace, fused into a finely porous mass of a dirty pearl gray color, covered externally with grains of iron.

This mineral is met with in potstone or serpentine rocks, either dispersed through them or accumulated in their clefts

and crevices, unmixed with any other substance. The most beautiful comes from the Tarentaise in Savoy; it is in white flexible filaments, sometimes a foot long, of a pure silk luster. In some parts of Corsica it is so common as to have been used by Dolomieu instead of hay or moss, to pack up specimens of other minerals in. The islands of Elba and Crete; Zoblit in Saxony; Stuartwick in Sweden; Cornwall and Anglesea in England, and Portsoy in Scotland, also furnish considerable quantities. A compact kind, which decomposes by exposure to the air into remarkably flexible threads, is found in the Ural mountains in Siberia. Amianthus is also found in great abundance in a few localities in the United States.

The fibrous texture of amianthus, its incombustibility, and the little alteration that it undergoes even in a strong heat, were early noticed, especially among the Eastern nations; and methods were found out of drawing the fibers into thread and afterward weaving it into cloth. This, when dirtied with grease or other inflammable matter, was cleaned by throwing it into a bright fire; the stains were burnt out, and the cloth was then removed, but little altered in its properties, and of a dazzling white. In the rich and luxurious times of the Roman Empire this incombustible cloth was purchased at an enormous price for the purpose of wrapping up the bodies of the dead previous to their being laid in the funeral pile. The practice of burning the dead falling into disuse, occasioned the manufacture of amianthine cloth to be neglected, and at length entirely forgotten in Europe; but though it ceased to be an article of luxury or necessity, yet the method of its preparation attracted the notice of travelers and occupied the time of the curious. Ciampini, of Rome, in 1691 gave the following method of preparing incombustible cloth: Having previously steeped the amianthus in warm water, divide its fibers by gently rubbing them with the fingers, so as to loosen and separate all the extraneous matter; then pour on repeatedly very hot water as long as it continues to be in the least discolored. Nothing will be now left but the long fibers, which are to be carefully dried in the sun. The bundles of thread are to be carded with very fine cards, and the long filaments thus obtained are to be steeped in oil, to render them more flexible. A small quantity of cotton or wool is to be mixed, and by means of a thin spindle the whole is to be drawn out into thread, taking care that in every part the amianthus may be the principal material. The cloth being then woven in the usual manner, is to be placed in a clear charcoal fire to burn off the cotton and oil, when the whole remaining tissue will be pure white amianthus. The shorter fibers that are incapable of being woven, have been sometimes made into paper; the process for which is the same as that employed for common paper, except that a greater proportion of paste or size is required. After having been made red hot, however, this paper becomes bibulous and brittle. Amianthus threads are also sometimes used as perpetual wicks for lamps; they require, however, to be cleaned occasionally from the soot that collects about them, and the fibers in the hottest part of the flame are apt to run together, so as to prevent the due supply of oil. In Corsica, amianthus is advantageously employed in the manufacture of pottery; being reduced to fine filaments, it is kneaded up with the clay, and the vessels which are made of this mixture are lighter, less brittle, and more capable of bearing sudden alterations of heat and cold than common pottery. Many patents have been taken out in recent years for various applications of this substance, some of the most important of which are as follows: lining for safes; lamp wicks; fire brick and crucibles; packing for engines of various kinds; boiler covering; for porcelain manufacture, of teeth especially, placed on the side of the muffle to isolate the biscuit from the slide and prevent its becoming attached thereto in the process of baking; as an anti friction composition for journals, etc.; for moulded articles; for roofing and flooring cement; for refrigerators; ink; paper; coffins; ropes, and yarn for weaving.

2. *Common Asbestos*.—The color of this mineral is leek or mountain or olive green; greenish or yellowish gray or grayish white. It is found amorphous, or investing other substances; the form of its filaments appears to be that of a very long rhomboidal prism; it is shining or glimmering, with somewhat of a greasy luster; its fracture is fibrous and much more compact than that of amianthus, passing into the broad striated. It flies, when broken, into long splintery fragments; it is translucent at the edges and may be scratched by the nail with some difficulty. Specific gravity 2.5 to 2.8. Wiegand gives the component parts of common asbestos as 48.45 magnesia, 46.66 silice, and 4.79 oxide of iron. This mineral is of more frequent occurrence than amianthus, being found almost universally accompanying serpentine, and very often mixed with magnetic iron ore. It passes by insensible gradations into the preceding species.

3. *Ligniform Asbestos*.—The color of this mineral is yellow or Isabella brown. It is found massive and is internally glimmering. Its fracture is thin and finely foliated; it is opaque, may be scratched by the nail, adheres to the tongue, and has a meager feel. Its specific gravity is 2.051. It is infusible *per se* before the blowpipe. It is met with principally in the Schneeberg of Tyrol in the same gangue with galena, blende, common asbestos, strahlstein, and gypsum.

4. *Mountain Cork* or *Mountain Leather*.—The color of this mineral is yellowish or reddish white, yellowish green, or ochre yellow. It is found amorphous in thick or thin plates; it is weakly glimmering internally. It has a thick, uneven, somewhat foliated fracture; is opaque, somewhat elastic, and floats upon water. The specific gravity is 0.68 to 0.99. Bergman gives the following analysis of its composition: 26.10 magnesia, 56.2 silice, 2 alumina, 12.7 lime, and 3 oxide of iron.—*Pottery and Glassware Rep.*

LIQUEFACTION OF OZONE.

Le Génie Civil gives an account of a successful attempt at the liquefaction of ozone which was recently made by Messrs. Hautefeuille and Chappuis. It is only recently that oxygen has been liquefied, and hitherto its strange allotropic form has resisted all efforts to change it from its gaseous condition. By subjecting a mixture of ozone and oxygen to a pressure of one hundred and twenty-five atmospheres, or nineteen hundred pounds to the square inch, cooling it at the same time by immersion in a jet of liquefied ethylene to a temperature of at least one hundred and fifty degrees below zero of Fahrenheit's scale, these experimenters succeeded in reducing it to a liquid of a very deep indigo-blue color, which, although obtained under such enormous tension, proved to have a certain amount of stability, and evaporated only slowly when the pressure was reduced one-half. Even under the ordinary pressure of the air some drops of the blackish liquid lingered for a few moments before they were again transformed into an azure vapor, which on returning to its ordinary condition proved to have undergone no chemical change.