

seem to be floated to the water's edge, where, upon the receding of the water in late spring, they are left stranded and find rooting.

Although most people have picked water lilies, few, save duck hunters and botany students, invade their haunts when the large pods are fully developed. The general arrangement by which their seeds are scattered is much the same in all. The largest and most beautiful of the group is doubtless the American lotus (*Nelumbo lutea*). Its seed pod is a large, round boat which holds fifteen or twenty passengers, each one with a separate berth. The large pod when green holds its seeds carefully by a firm rim about the shoulders of each one. When ripe these pods are apt to break off and float away, carrying their precious passengers with them. Gradually the rim about each seed expands until the seeds drop out and find lodgment in the mucky soil, often six or eight feet below the surface.

An agent which does more service in scattering seeds than is usually supposed is the ice. Here and there along rivers and lake margins are to be found plants of many kinds, grasses, and rushes; also upon their banks are certain trees, bushes, and vines, all of which hold at least part of their seeds during most of the winter. It matters not of what sort the seed may be, if it falls upon the ice the wind will skid it along until it meets some obstruction, which is apt to be a further shore. I have found box elder seeds imbedded in the ice of a river far from their trees.

When the ice of rivers breaks up in the spring and is hurried away in the swollen stream, the rushes, grasses, and plants of many kinds which have been frozen in at the river margin, are carried away with it.

Nearly all the forces of nature seem to be in league to scatter seeds with utmost thoroughness. Wind and rain, snow and ice, lake, river, creek, brook, even to the tiniest rivulet, all have a part in the important, though largely unseen task.

(To be continued.)

CHINESE RHUBARB.*

By E. H. WILSON.

SOME difference of opinion exists as to the actual species yielding the Chinese rhubarb of commerce. In this article I shall endeavor to show that while it is possible two or more species may be involved, the bulk of the commercial drug is furnished by one species—viz., *Rheum officinale*, Baillon.

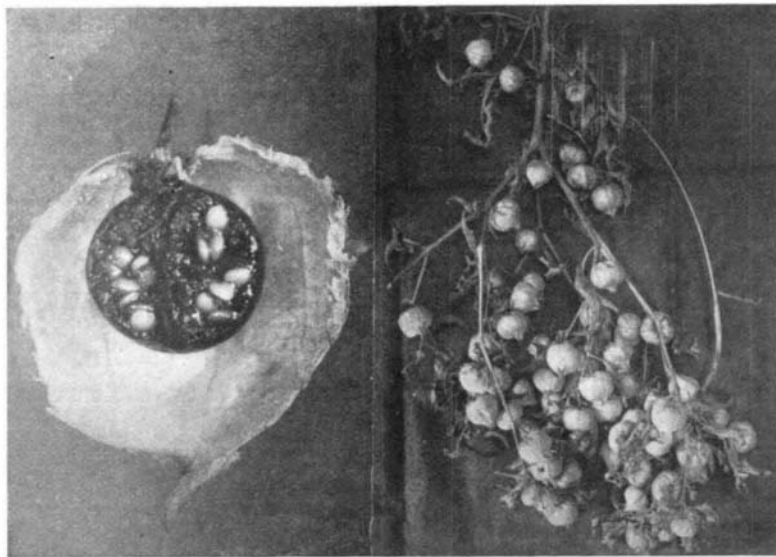
The chief source of the drug is the wild mountainous region of the Szechuan-Tibetan border, and the range of mountains extending from this border to the province of Hupeh, Central China. This range (Kiu-tiao-shan) separates the province of Szechuan from Kansu and Shensi, and forms the watershed of the Han and Yangtze rivers. A certain amount of the medicinal product is collected in Hupeh, and finds its way to Hankow, where it is classed with the Szechuan product. In the imperial maritime customs trade returns, the whole of the rhubarb exported from Hankow is given as Szechuan rhubarb, and there can be no question that the chief source of the drug is the mountains of Western, Northwestern and Northern Szechuan.

Dr. Henry, in 1888, was the first to discover wild specimens of the medicinal rhubarb in the mountains of Hupeh. The plant was found growing in the forests between 7,000 and 9,000 feet above the sea level. Henry forwarded specimens to Kew, where they were identified as *Rheum officinale*, Baillon. In 1900 I rediscovered the plant in Henry's region and sent seeds to this country. Plants were raised from my seeds, and on flowering and fruiting proved the Kew determination of Henry's specimens to be correct.

Hupeh plant. Of this I am convinced not only from actual knowledge of the living plants in both districts, but also from comparison at Kew herbarium of the specimens I brought from both regions. My knowledge of the wild plant as it occurs in Szechuan-Tibetan

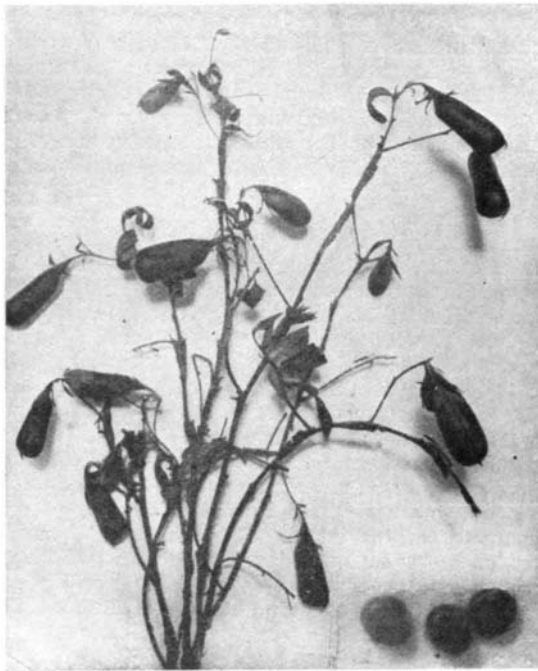
mum age, but this is probably not strictly adhered to. The forest product is not so highly esteemed as that found growing on the grass lands above tree limit.

"Ta huang" is the name by which the drug is known all over China.



THE SEED BALLOONS OF THE GROUND CHERRY. THE DIVIDED BALLOON AND SEED VESSEL ARE ENLARGED.

border extends from south of Taitien-lu to north of Sungpan, on the Kansu border. The plant occurs in the forests 8,000 feet above sea level, becoming more abundant and reaching its maximum between 11,000 and 12,000 feet. It extends up to 14,000 feet, the



THE INFLATED PODS OF THE RATTLE BOX.

highest altitude of any tall-growing herb in these regions.

Rheum officinale is a striking plant, with its large, handsome, dark-green leaves and tall, loose inflorescence of white flowers. 7 to 8 feet high. The fruits

The latter half of September and October is the season for digging the rhubarb, but the process is carried on until the snow finally renders it impossible. Occasionally a spring digging is resorted to. This takes place before the plants begin to make much growth.

Rheum officinale has a distinct stem, not very long, but thick, and this, I was informed, was considered better than the roots. It is severed from the roots, cleaned, the bark and crown removed, and then split transversely, or more commonly longitudinally, into pieces 4 to 6 inches long. Sometimes a hole is bored through the pieces and they are strung on a cord and dried under the eaves of the houses. The roots vary in size and are often very large—4 to 5 feet long and 3 to 4 inches in diameter is not unknown. These roots have all the weak laterals removed, and are cleaned, roughly trimmed, cut into lengths, and often divided longitudinally.

At Taitien-lu, where the climate is very moist, partly drying the freshly gathered roots over brushwood fires is often resorted to. The medicine-gatherers only trim and prepare the drug very roughly; it is in the shops and warehouses of the dealers at Chungpa, Mienchu, Kuan, Hsien, and Yachow that the drug is finally trimmed, sorted, and graded ready for export.

The Taitien-lu product is carried overland to Yachow, where it is put on rafts and brought to Kiating. At Kiating it is placed on boats and shipped to Chungking. The Chinese esteem the Taitien-lu drug the least valuable on account of the moist climate necessitating the application of much direct heat.

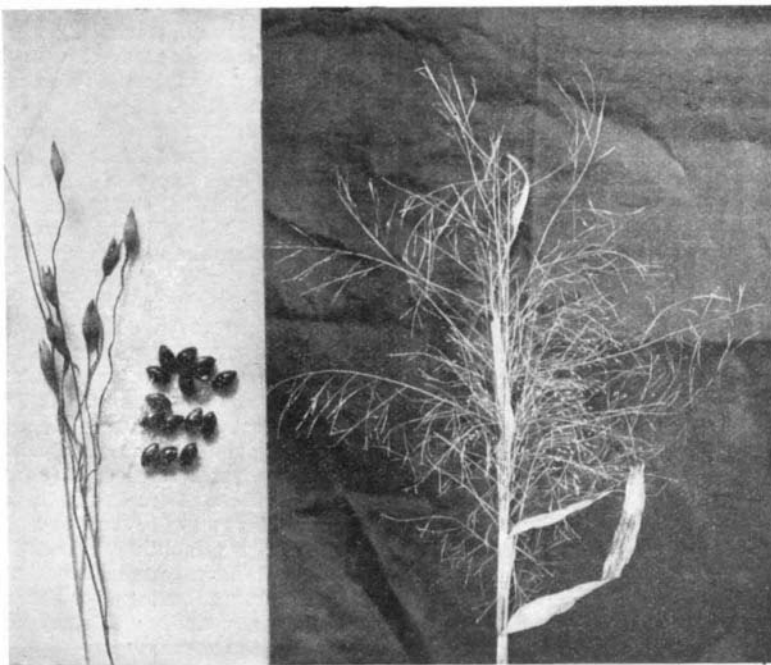
The climate around Sungpan is much drier than that of Taitien-lu, and the rhubarb is rarely subjected to direct heat of any kind. It is collected mainly by Sifans, and after trimming and preparing is stored beneath the rafters and eaves where it can get plenty of air until it is dry and ready for disposal.

The bulk of the Sungpan product and that of Northwestern Szechuan generally is carried overland to Chungpa and Mien-chu, and there put on boats and shipped to Chungking. A certain amount of rhubarb collected to the west and south of Sungpan passes down the Min Valley to Kuan Hsien and Ghentu. A considerable amount of rhubarb is collected by the tribesfolk inhabiting the nondescript country west of Wen-chuan and thence to Kuan Hsien, or by another route direct to Kuan Hsien. Much of the rhubarb brought to Kuan Hsien is sent direct to Chungking, but some is sent by way of the provincial capital, Chengtu.

In Chengtu the price of rhubarb in 1904 was taels 35.00 per picul (tael = about 3s. and picul = 133 1-3 pounds).

Rhubarb is occasionally cultivated in the mountains of Hupeh, and Western China, notably Mount Wa; but cultivation is not much practised, as the cultivated article is considered very inferior to the wildling. With the exception of "Huang-lien" (*Coptis chinensis*), "tan-kuei" (*Ligusticum Thomsonii*), and "aconite" (*Aconitum Wilsonii*), the Chinese hold the same opinion in regard to all their vegetable drugs.

While the bulk of the rhubarb exported from Szechuan passes through the port of Chungking, not all of it comes under the imperial maritime customs, with the result that the actual quantity exported cannot be traced. However, if the customs returns for the port of Ichang be taken, a fairly accurate estimate will be obtained, since at Ichang the native customs also come under the control of the imperial maritime customs. In 1904, according to the published returns, rhubarb to the extent of 11,218 piculs, valued at 473,415 Haikuan taels (H. tael equal 2s. 8d. approximately), passed through Ichang. All the Ichang exports pass through Hankow and are there transhipped. The export of rhubarb from Hankow in 1904 was: Hankow to Chinese ports, 865 piculs, value H. tals. 11,851; Hankow to Hongkong, 7,768 piculs, value H. tals. 419,472—a total of 8,633 piculs, valued at 431,323 H. tals. As mentioned previously, all rhubarb exported from Han-



THE TUMBLING HEAD OF THE PANICUM GRASSES, WITH ENLARGEMENT OF SEEDS AND SEED STEMS.

During 1903 and 1904 I was engaged in a botanical exploration of Western China, and came across the medicinal rhubarb in great quantities. It was always the same species, and undoubtedly the same as the

* From the London Chemist and Druggist.

are salmon red, and even more conspicuous than the flowers.

The medicine gatherers of these regions root up only the oldest specimens, which from experience they readily recognize. Ten years is regarded as the mini-

kow is classed as Szechuan rhubarb, and is undoubtedly furnished by the one species, *Rheum officinale*, Baillon.

In 1872-73 the Russian traveler Prezewalski discovered in the northwest of Kansu and the Kokonor region (36 deg. to 38 deg. N.) a rhubarb yielding a medicinal drug. Specimens were obtained, and subsequently living roots were transported to St. Petersburg, and the plant named *Rheum palmatum* var. *tanguticum*, by Maximowicz. This variety is said to be native of the woods and forests 10,000 feet above sea-level, affecting ravines with a rich, loamy soil and north aspect, and seldom found on southern slopes or on the bare mountain slopes (in this it will be seen that the plant is much more particular than *R. officinale*). According to the traveler the plant is dug up in September and October. The lateral roots are cut off, the outer rind removed by a knife, and the roots cut transversely into segments or divided longitudinally into large pieces, constituting the "flats" and "rounds" of commerce. Prezewalski says that this Kansu drug is carried overland in winter, and by boats down the Yellow River in summer, to Peking and Tientsin.

The imperial maritime customs trade returns show that a certain amount of rhubarb is exported from Tientsin, the article being styled "Chihli rhubarb." In 1904 the Tientsin exports of this drug were: To Hongkong 1,528 piculs, valued at 8,405 Hk. tls.; to Chinese ports 176 piculs, valued at 968 Hk. tls.

Chefoo also exports a small quantity of rhubarb, the source of which is not stated. In 1904 Chefoo exported to Hongkong 56 piculs of rhubarb, valued at 1,478 Haikuan taels. We do not know the source of the rhubarb exported from Tientsin and Chefoo. It may be *R. officinale*, *R. palmatum* var. *tanguticum*, or some other species, but from the value given it is almost certainly a local product. Maximowicz asserts that in Dahuria, *R. rhaponticum* is the species yielding the drug of those regions. It may be that it is this same species which yields the Tientsin and Chefoo drug. However, be this as it may, from the export values given in the above return it seems safe to say that neither Chefoo nor Tientsin exports the Kansu rhubarb. It is possible that Kansu rhubarb reaches Russia by the overland route, but there is certainly nothing to prove that it is ever exported by sea to Europe. Personally, while admitting the possibility of the Kansu drug reaching Russia by the overland route, I incline to the belief that the drug is merely of local value and use. Setting aside the botanically unknown Chefoo and Tientsin drug, the weight of evidence seems to prove that the whole of the rhubarb exported from China by sea to foreign countries is the product of one species, and that species *Rheum officinale*, Baillon.

SOME HINTS ON MELTING METALS AND ALLOYS.

By WALTER J. MAY.

In the practical work of the foundry metals and alloys have to be melted, and alloys have to be made, the general objective of the operations being to perform them at the least cost in fuel, loss of metal, and, what is often overlooked, with the least cost in crucibles. To secure these points, which are essentially of a practical character, a goodly amount of very practical common sense must be exercised by both employer and fireman, and unless the fireman has some considerable experience and is interested in his work, losses of a preventable nature will surely occur. Usually the price of castings of all kinds is low; in fact, often lower than is compatible with the use of the best metal and labor, and particularly in such cases does the most careful melting tell in regard to costs, as scrap has to be largely used, and in melting this there is room for either making or preventing losses of rather an important nature.

Good furnace coke, as free as possible from sulphur, should be used, especially where plumbago crucibles are employed, and although this necessarily costs more per ton than gas coke, it costs less per ton of metal melted when used by a good fireman, and the crucibles last longer, which tells in calculating the actual costs. The heat can be better controlled with hard coke than with soft stuff, and taken as a whole it produces results which are much more satisfactory.

The question of crucibles is important, as in many cases intermittent using has to take place. For some metals and alloys plumbago crucibles are an absolute necessity, and for some things, such as aluminium, special linings are necessary, or at least desirable, if the best results with the metal are desired. Clay crucibles are initially much cheaper than those made of the plumbago composition, but when once fired, as a rule they are done for if allowed to cool below a certain point, and for this reason it may be taken that they only last for from six to eight meltings, or, to put it more broadly, they only do one day's work. On the other hand, plumbago pots of good make will last until burnt out, or otherwise destroyed, but an average of from thirty to thirty-five charges of iron may be taken where a careful fireman handles them, and where the metal is poured as soon as melted. Metal should never be allowed to set in any form of crucible, as this is a fruitful source of destruction. Any good make of crucible will give good results, and generally each operator has his own particular choice, and naturally each man prefers to use pots of his own choice, the writer preferring Morgan's, while others prefer Doulton's or other good makes. Where possible, it is always preferable that the fireman's choice should be

respected if he knows his work, but otherwise the selection should not be left to him.

The lifting tongs should be well made to fit the crucibles without crushing them, and there should be tongs for each shape and size of crucible used. It is quite safe to say that more crucibles are destroyed by using badly-fitting tongs than any other cause, and as tongs last an indefinite time when once in stock, they are not often having to be renewed. Bowed coke tongs should be provided, and those with flat jaws should be avoided, because if used to grip a crucible—and they will certainly be so used occasionally—they are apt to split or break the edges away. Block tackle should always be provided for lowering and lifting the crucibles where economy is desired, as this largely saves them from damage, while the cost of a girder and the carriage and blocks is not excessive, and they are practically everlasting. To haul a large and heavy pot from the furnace by means of the tongs and a hook manipulated by a couple of men is not an altogether easy operation, and it does not conduce to careful handling, while lifting by means of blocks gives a dead lift with the minimum exercise of trouble and strength.

Where convenient, tilting furnaces of the Morgan type prove economical, as the crucibles are not knocked about in pouring, while large weights of metal can be melted with economy. Either pouring against the furnace or crane work can be arranged for with these furnaces, the most convenient form for the general work of the place being selected as a matter of course. Usually, however, some of the ordinary furnaces will be required for small pots, but this is a matter dependent on the class of work which has to be done. Anyway, with brass and other alloys, each casting should, as far as possible, be poured from one melting of metal to insure as uniform a content as possible; and it must be borne in mind that stratification is not an unknown quantity when dealing with mixed metals.

Coming to the actual melting, all metals should be poured as soon as melted, and should not be kept in a molten state in the crucibles, otherwise both metal and crucibles are liable to injury, to say nothing about the loss of metal and the unnecessary burning away of the crucible. Further than this, some metals—aluminium and its alloys, for instance—absorb silica and other material from the crucibles, and when this takes place the castings become hard and often brittle. The molds should be ready in advance of the metal rather than the metal being ready in advance of the molds, and save in a few exceptional cases this should be made an invariable rule.

The heat at which metals are melted should not be in excess of that which is really required, as anything in excess of this always proves bad for the metal, while it is wasteful in itself. Not only do we get waste by using excessive heat, but with many alloys we get a change in the content of the alloy; and, taking brass as an example, it is quite possible to burn out so much of the zinc as to entirely change the character of the metal. The ash or dirt on the surface of overheated metal represents loss of metal, and this should be avoided as much as possible for the sake of economy, if for nothing else. Besides, the strength of the alloy is altered by bad treatment, and where made under a guaranteed test, castings made from such metal are very likely to be rejected.

To reduce the ordinary loss as much as possible by maintaining a reducing—as opposed to an oxidizing—atmosphere in the crucible, a handful of rather coarsely granulated charcoal should be thrown in before the charge of metal is placed in the crucible, this very largely preventing oxidization. At the same time, it is doubtful if it wholly prevents it, because at temperatures below that of fusion most metals and alloys absorb oxygen pretty freely, and if above the top of the crucible at that critical period, no amount of carbon in the crucible will prevent it. The same applies when melting under gas is adopted, gas being far better than any solid deoxidant, and for this reason the unmelted metal should not project above the top of the crucible. Necessarily, subsequent additions of fresh metal must be made, but this secures a saving of metal which more than compensates for the trouble involved. Melting under gas is a cheap method of preventing oxidization, and is well worth more general attention than is at present paid to it, but, of course, not being generally adopted, most foundry melters ignore its very undoubted advantages.

When melting scrap metal a handful of plaster of Paris or other dry material like it in character, placed in the bottom of the crucible before putting in the charge of metal, will usually bring up all dirt, and leave a bath of clean metal; but it must not be taken to be a flux which will remove every objectionable element in the metal. Certainly it removes the bulk of the mechanical impurities, but it does not remove everything which should be taken out, and the use of some deoxidant is often necessary in addition. In almost all cases where scrap metal is being dealt with some flux, either chemical or metallic, will be found necessary to obtain good castings, but the cost has to be low as a rule, and for this reason some chemical combination has to be used. With new metals the case is somewhat different, although it cannot be gained that a certain amount of fluxing in some form or other is generally used. Careful melting is the chief thing, but still occasions arise when the addition of something outside the mere metal melted gives results of an advantageous character.

Fluxes may be divided into two classes—metallic and chemical—although both produce chemical reac-

tions. In the first class we have ferro-manganese, phosphor tin, arsenical copper, and others of a like character, these being more or less perfect metallic alloys; and in the second class we get borax, sodium salts, phosphorus, fluorspar, and the like, and combinations of metallic salts with earthy materials, which may or may not have received special treatment on which the efficiency of the fluxing properties may or may not depend. Speaking generally, there is no fluxing material useful for all metals alike, and usually manufactured fluxes are only useful for the metals or alloys named by the makers. The use of fluxes seems to somewhat follow the same course as fashions in dress, as at one time chemical fluxes and at other times metallic fluxes become the rage or fashion, and after a period these conditions change quite independently of the actual effect of the fluxes on the metals to which they are applied. Thus at one time we had borax, then phosphorus, and then aluminium as brass fluxes, quite independently of their suitability, and probably something else will follow. In any case, however, the chief thing to use is some good deoxidant, which is suited to the metal or alloy being dealt with, and, given this, proper mixtures of metal and good melting should give all that is necessary for the production of sound castings so far as the melter is concerned.—The Practical Engineer.

ACETYLENE VS. COAL GAS OR ELECTRICITY.

In a recent number of The Electrical Review Mr. Horace Allen has the following to say about the demerits of acetylene for lighting:

"Though the demand for acetylene gas has steadily and continually increased ever since calcic carbide became a commercial commodity less than fourteen years ago, through the development of the electric furnace, it is doubtful whether it will ever seriously enter into competition with either coal gas or electricity in the field of general and economical illumination for public or domestic purposes, or for power development, on account of the high cost of calcic carbide. So long as electricity is employed in its manufacture, the possibilities in the way of the price ever coming within the range of competition are very remote. Added to the cost of manufacture, there is necessitated the expense of packing in hermetically sealed drums and tin canisters, owing to the great affinity of calcic carbide for moisture.

"Pure acetylene gas is credited with having a faint, sweet smell, but the smell given off by all the carbide the writer has had the opportunity of examining has been quite the reverse of either faint or sweet.

"The unpleasant odor arising from raw carbide upon opening the receptacle is a primary source of objection, and any neglect in the way of resealing the drum after the withdrawal of the required quantity, results in the continued gradual generation of acetylene and its objectionable smell. For this reason the best place to store carbide is at some considerable distance from any occupied building.

"Various methods have been applied to overcome this serious drawback in the way of coating the carbide, and by counteracting the smell by the application of strong, sweeter smelling essences. However, such treatment has chiefly been confined to small retail parcels, for which a higher price has to be charged to cover the additional treatment.

"The method of dipping the carbide into petroleum, and then into glucose, resulted in a material that was almost entirely protected from the atmosphere and free from any objectionable odor, besides having the further advantage of being much more slowly acted upon by water.

"However, even this treatment does not entirely remove the tendency to continue the evolution of acetylene gas after the consumption has ceased, a very serious source of trouble in all generators using raw, or untreated, carbide. Another feature in connection with the action of carbide and water in the generation of acetylene is the amount of heat given off in the reaction.

"One pound of carbide, when brought into contact with water, gives off in its decomposition 753 B. T. U., which, in the absence of an excess of water, is sufficient to raise the temperature of the surrounding materials to a bright red heat. On this account, all apparatus for the generation of acetylene which is not provided with a sufficient quantity of water to insure the dissipation of the heat evolved, is liable to become heated to a dangerous point in case of too rapid a consumption of gas. When this happens, the acetylene becomes decomposed, as is evident by the black material in the residual lime.

"To a certain extent, calcic carbide resembles the electric accumulator or storage battery, for while by present processes it requires the expenditure of from 2.0 to 2.3 horse-power hours to produce one pound of carbide, this may be conveyed to any distance, or stored for any length of time, if properly protected, and then the acetylene generated from it is capable of developing 1 horse-power for one hour if used for driving a gas engine; this, by the way, is not a demerit, but the reverse.

"By virtue of this property it can be used to transfer energy from waterfalls in distant situations to localities where it could be turned to useful account.

"The residual lime remaining from the decomposition of calcic carbide in the generation of acetylene has a very unpleasant smell when first brought out of the generator—so much so that, in the case of small apparatus, it is offensive if brought anywhere near inhabited rooms. The sludge settles down into