TURPENTINE DERIVATIVES.

BY DR. L. REUTER.

Referring to the interesting paper on "Pine Products," written by Mr. Th. W. Pritchard for the SCIENTIFIC AMERICAN SUPPLEMENT, I would like to say that there are several important products made in Germany from American spirits of turpentine which are not as yet manufactured in the United States; these products are terpin hydrate and terpineol.

The first named article, the terpin hydrate, has attained such an importance as a valuable remedy, that it has even found a place in the U. S. Pharmacopœia, where its properties are fully described and methods given for the examination of its purity.

Although prepared from turpentine, terpin hydrate is, when chemically pure, an absolutely odorless substance and crystallizes in beautiful colorless prisms. It is used as expectorant, antiseptic, diuretic and diaphoretic in bronchial affections, whooping cough, throat affections, tuberculosis, and many other diseases, and it is employed so extensively, that about 35,000 pounds of it are imported from Germany, where it is manufactured in chemical factories exclusively from American spirits of turpentine. Being a chemical compound under the regulations of the Tariff Act of July 24, 1897, it has to pay a duty of 25 per cent *ad valorem* on entering this country.

The second turpentine derivative not yet manufactured here is terpineol or synthetical lilac; it is an oily liquid and possesses a very agreeable odor which is almost identical with that of lilac flowers; it is used as a base for quite a number of perfume compositions, and a solution of it in alcohol mixed with some heliotropine, etc., is considered to be one of the best lotions which we have for scalp and face.

About 45,000 pounds of terpineol are annually imported from Germany; like terpin hydrate it pays a duty of 25 per cent *ad valorem*.

Before entering into the details of the manufacture of these two articles, I wish to state that the proper locality where the same could be cheapest and best manufactured, is the southern part of this country, especially the pine-regions, where spirits of turpentine is made on a large scale either from turpentine or by distillation of pine wood. In these districts the manufacture of the above mentioned and of other even more important turpentine-derivatives like synthetical eucalyptol, synthetical borneol, the latter being manufactured to a very great extent at Leipsic for consumption in the Far East, synthetical camphor, etc., should be developed, and it would be an easy task to supply the world from here with articles of as good a quality and as cheaply or cheaper than German factories.

American manufacturers would have a further advantage in so far as they could use certain discolored grades of turpentine or grades obtained from pine wood by destructive distillation and containing traces of creosote, etc. That such cheaper grades can be used for manufacturing purposes, that the yields and the quality of the final products are perfectly satisfactory, and that the products are identical with those made from the purest spirits, I can confirm from my long practical experience in that special line of manufacturing.

Two methods are used in these days for the manufacture of terpin hydrate—the first of which consists in exposing to the air in flat dishes a mixture of spirits of turpentine, nitric acid, and alcohol, separating the crystals which are formed after some time and purifying the same by recrystallization. This method can be used profitably, especially in such countries where the price of alcohol for industrial purposes amounts to less than one-tenth of that to be paid in this country.

I used this method successfully for a number of years and while experimenting with the mother-liquors, left after the separation of the terpin hydrate crystals, I made a very interesting discovery, which will, if technically fully developed, open new and important opportunities for the development of industry and commerce in the South.

While experimenting, as stated, with the mother-liquors of the terpin hydrate manufacture for the purpose of finding a better outlet for that by-product than that for which it has been used, namely for varnishes, etc., I discovered that it contained up to 5 per cent and sometimes even as much as 9 per cent of eucalyptol, which is the most valuable constituent of the oil of certain eucalyptus species, especially of *Eucalyptus globulus*, Labillardière, the Australian blue-gum tree. Thanks to the indefatigable labors of Hon. Abbot Kinney, Hon. Ellwood Cooper, Mr. A. Campbell-Johnston and others, that tree is now extensively cultivated in Southern California. Many tons of eucalyptus oil are consumed in this country, 90 per cent of which is imported from Australia by way of England; and also very large quantities of eucalyptol, extracted by special methods from eucalyptus oil in German chemical factories, are imported in the United States, paying a duty of 25 per cent *ad valorem*, $1.00 to $1.20 being realized per pound for that quality which answers the requirements of the U. S. Pharmacopœia.

As the eucalyptol which I obtained as by-product in the manufacture of terpin hydrate is chemically and physiologically identical with the natural eucalyptol, it is only a question of time when it will ultimately be made from spirits of turpentine exclusively, and as any cheaper grade of spirits can be used for making eucalyptol, the most favorable locality for its manufacture will naturally be the pine districts of the South.

When the process of making eucalyptol from turpentine will be fully developed in this country, it will become necessary to protect that new industry by a prohibitive duty of at least 50 cents for each pound of eucalyptol and also 50 cents for each pound of eucalyptus oil "containing 20 per cent and more eucalyptol." It would not do to impose only a duty on eucalyptol, as it is very probable that if only the duty on that article is raised, it will be invoiced and imported as oil of eucalyptus. While a duty of 50 cents on each pound of eucalyptus oil containing 20 per cent or more of eucalyptol would protect the manufacture of synthetical eucalyptol, the duty on ordinary eucalyptus oil, which contains principally phellandrene and only a very small quantity of eucalyptol, could remain as fixed by paragraph 3 of the Tariff Act of July 24, 1897, namely 25 per cent *ad valorem*. Of course, it is to be expected then that the Treasury Department will have all the imported eucalyptus oil examined chemically as to the percentage of eucalyptol it contains.

And now a few words in regard to the manufacture of synthetical camphor from spirits of turpentine. In the SCIENTIFIC AMERICAN of November 21, 1903, an interesting paper was published concerning the manufacture of this article at Port Chester; unfortunately the manufacture has recently been abandoned, probably because of the great expense of materials. The proper locality to manufacture this article would have been the South, for the following reasons: The two principal raw materials entering in the manufacture of synthetical camphor are spirits of turpentine and oxalic acid; in regard to the first item, the spirits, I have to say, the cheaper grades of that article, viz., such as are obtained in the destructive distillation of pine wood and containing traces of creosote, will do for making camphor, and such grades could have been purchased in the South for less than half the price which had to be paid for the pure market article. Also expenses for shipping of raw materials, for barrels, etc., would have been reduced to a minimum if that industry had been started in the turpentine districts. As a matter of fact, every young industry needs conscientious and conservative development, and the nearer the factory is located to the source of the raw materials the more independent will it become and the more profitable will it prove to be in the end.

The second raw material for the making of camphor is oxalic acid. Though some of that article is manufactured in this country, there is still a considerable quantity imported. In 1903, 5,363,646 pounds, valued at $257,289, were imported. Oxalic acid is on the free list of the tariff of 1897 and that is the reason why its manufacture has not been developed. If the fact is considered, that the principal raw material for making oxalic acid is sawdust, which goes to waste or is obtainable nowhere cheaper than in the lumber districts of this country, it is evident that oxalic acid can be made here as cheap or cheaper than anywhere else.

In my opinion both industries, the manufacture of oxalic acid and of synthetical camphor, should be taken up jointly in the South by one and the same company. Oxalic acid at manufacturing cost price would naturally be a good deal cheaper than the article purchased from other manufacturers or from importers, and, at the same time, all oxalic mother-liquors could more easily and more cheaply be re-converted into oxalic acid.

But why not go a step further? Why not protect such important industries by prohibitive duties, especially if such industries can stand exclusively on domestic raw materials? If on crude camphor, which enters duty free, a duty of 50 cents per pound is imposed (imports, 1902, 1,831,058 pounds, $576,405; 1903, 2,508,420 pounds, $764,403); on refined camphor instead of the present duty rate of only 6 cents per pound also a duty of 50 cents per pound and on oxalic acid a duty of 10 cents per pound, there can certainly be no doubt that the above-mentioned industries depending solely on American materials would flourish and become very profitable enterprises. The country at large would learn to become independent from imported crude materials and would stand on its vast resources; and last, but not least, the Southern States would be brought on a better footing with the manufacturing States and on a higher level generally.

Several patents for the manufacture of synthetical camphor from spirits of turpentine have been granted here and in Germany. A number of chemists are actively engaged in the scientific laboratories of large factories in Germany to develop the technical process of making camphor. It is not to be doubted that the synthesis of camphor will be realized in the near future and that some day we shall read in the newspapers that Germany does not need natural camphor from the Far East any longer, that she succeeded in standing on her own resources in regard to camphor as she succeeded so gloriously in making herself independent from natural indigo by carrying out on the grandest scale the manufacture of synthetical indigo from coal tar.

It is to be hoped that when this time arrives the problem of manufacturing synthetical camphor will also have been solved in this country. Likewise, that our far-sighted philanthropists, who so liberally provide enormous annual sums for medical, electrical, and general engineering sciences, will have recognized the necessity of providing means for original synthetical research-work, a science of greatest practical importance, which thus far has been utterly neglected in this country, and which will prove not only a blessing to organic-synthetic chemistry, but through it, to humanity at large.

SCIENCE NOTES.

A discovery of considerable importance was made in August last at Suse, the ancient Segusio, in the province of Turin. Some excavations were being made near the Arch of Augustus at a place which has already yielded some objects of great value. At a depth of six feet or more a colossal man's head was found. It is of bronze and is double the natural size. The head is of excellent workmanship, and is well preserved. It is supposed that the head belonged to a statue of the minister of Augustus, Marcus Vipsanius Agrippa, who was the husband of Julia, daughter of Augustus. Agrippa was the grandfather of Caligula and the great-grandfather of Nero. He died in the year 12 B. C. The excavations are being continued, in the hope of further finds.

M. Gauckler has recently given an account of the results which have been obtained by the exploring expedition in the region of North Africa which was formerly known as the *limes Tripolitanus*. The explorations are being carried on by the Tunisian Society of Antiquities and Arts, of which this eminent savant is the head. The society is aided by the officials of that country. Among others is the recent discovery of Lieut. Pericaud. At 10 miles from the post of Matmata, in the most remote part of the mountainous mass of the same name, he discovered a fortified Roman farm, which is the most important of the remains hitherto found in this region. The Roman civilization, of which this is a trace, was established in the south of Tunisia in the second and third centuries A. D., following the military occupation of the country.

From his previous experiments on the action of N-rays Charpentier has been led to inquire whether there is a specific reinforcement when there is placed near a sensorial organ or the corresponding nervous centers the physical excitant capable of acting upon them. He finds, for instance, that when a phosphorescent screen is made having for base an odoriferous substance, the luminosity of this screen is increased opposite the nervous centers, especially near certain of them which may be called olfactory points. Similar effects occur in the case of the organs of vision and the related nervous centers when a screen with a luminous base is used. It is inferred from the experiments: (1) that the sensorial nervous centers are specifically different; (2) that there is a certain adaptation not only between physical agents and the sensorial agents destined to receive them, but between these agents and the nervous centers which perceive them after reception by the sensorial agent; (3) that there are certain common properties implying analogy of nature between sensorial excitants and the peripheral or central nervous organs destined for their perception, since they show by the sort of specific resonance referred to, analogous emissive properties.

In a recent issue of the Archives des Sciences Physiques et Naturelles, Messrs. Jacquerod and Perrot record their investigation on the melting point of gold and the expansion of some gases between 0 deg. and 1,000 deg. C. The thermometer used was a gas thermometer, in which the glass bulb was replaced by a bulb of silica soldered to a capillary tube connected with the manometer and likewise made of silica, this being a very refractory material, whose expansion is about twenty times less than that of platinum. A piece of gold wire, placed beside the bulb in an electrically-heated furnace, closed an alternating electric circuit including a telephone; the latter would cease vibrating at the moment of melting. According to these experiments, the melting point of gold on the nitrogen thermometer scale (with constant volume) would be in the neighborhood of 1,067 deg. C. On the other hand, it is shown that the average coefficients of expansion of nitrogen, oxygen, air, and carbon monoxide, between 0 deg. and 1,000 deg. C. may be taken as identical, whereas the coefficient of carbonic acid is somewhat less than its value between 0 deg. and 100 deg. C. These experiments are to be repeated with helium thermometers.