ARTIFICIAL CAMPHOR.

BY A. FREDERICK COLLINS.

Within twenty-five miles of New York city, at Port Chester, a plant has been erected, the science of chemistry is doing its work, and a natural product of worldwide utility but of heretofore limited and distant supply is being manufactured on a commercial scale. The substance obtained by the process here in operation is camphor—true camphor artificially produced. The distant and uncertain supply of camphor, the gradual destruction of its trees, the length of time required to grow new ones, and lastly the camphor monopoly, have stimulated chemists to devise a process of manufacturing camphor synthetically; by this it is meant that they have striven for the chemical extraction of certain principles from some of the essential oils, which treated and combined with other chemicals would result in the product sought.

After many months of laborious research by a corps of expert chemists, a principle was discovered and a process developed by the Ampere Electro-chemical Company, which gave promise of commercial success. The discovery was made during the course of some experiments in the synthetic formation of one of the essential oils, when in the product obtained a slight odor of camphor was detected. This hint was followed by the most painstaking and persistent care, but month after month went by before any actual camphor was obtained, and then the yield did not amount to more than two per cent of the material used. Though the results were at first meager indeed, by continued investigation, however, a yield of twenty-seven per cent of the raw material was finally obtained, but it required nearly two years to accomplish this result.

Generally speaking, all of the essential oils and allied compounds belong to the terpene family; that is, they are hydrocarbons. The discovery made at the Port Chester plant was that by introducing the carboxyl group into turpentine, two new compounds resulted, both of which were readily converted into camphor. The possibility of this transmutation is the more readily seen when it is remembered that turpentine, derived so abundantly from the pine trees of our own southern forests, is, chemically considered, $C_{10}H_{16}$, whereas camphor, derived directly from the camphor tree of far-away Formosa, is $C_{10}H_{16}O$; that is, the only chemical difference between turpentine and camphor is one atom of oxygen. Turpentine is derived from the pine tree very much as sap is obtained from the maple. It is in fact pine sap distilled and purified. In this state it is found to consist of ten atoms of carbon united with sixteen atoms of hydrogen, and the distilled juice of the pine tree and the distillate from the wood of the camphor tree differ only by the addition of one atom of oxygen to the latter.

By introducing a carboxyl into pinine, which is the essential and main constituent of the American and French oil of turpentine, two new compounds are formed, namely, pinyl oxylate and pinyl formate, and both of these can by simple chemical means be converted into camphor. The oxalate yields camphor by distillation with steam in the presence of an alkali; the formate under the same treatment yields borneol camphor, which is a hydrate of the product sought for, and by simple oxidation yields camphor.

The borneol camphor, aside from being easily converted into pure camphor, is a constituent of many natural essential oils and perfumes. It occurs in small quantities in nature, and is quoted in the open market at about ten dollars per pound. After nearly two years of experimental research in the laboratory, the process gave such promise of practical results that it was decided to construct and operate a small commercial plant, and this was carried out at the Ampere company's development station at Niagara Falls. A small equipment capable of producing in the neighborhood of one hundred pounds of camphor a day was constructed and operated for almost a year, and from the data thus obtained the present manufacturing plant was designed, built, and operated.

In the steam-jacketed reaction tanks, shown in Fig. 1, oil of turpentine weighing at least two thousand pounds is placed, together with anhydrous oxalic acid, the result of this reaction being pinyl oxalate and pinyl formate. After the completion of this step in the process, the mass, which is liquid, is pumped into a set of stills for treatment. Here it is distilled with live steam in the presence of an alkali, the resultant formation occurring as ordinary camphor and borneol camphor dissolved in the oily products of the reaction. These oils are fractionally distilled to extract the camphor and borneol further. After the pleasant-smelling oils have passed over, the camphor and borneol distill in the steam and are precipitated in the condenser in a white mass somewhat resembling boiled rice. The crude product is then forced by compressed air through a filter press, and thoroughly washed to free it from all traces of oil, when it is dropped into an oxidizing tank, where the borneal oxidizes into ordinary camphor.

The mass is again transferred to a rapidly-revolving centrifugal machine, where the oxidizing liquors are thrown out, and the camphor, being heavier, remains behind, comparatively pure, but stained from the oxidizing compound, so that it resembles light-brown sugar. After removal from the separator it is placed in a large steam-jacketed sublimer. In this vessel a slow heat frees it from any water it may contain, and the temperature is then raised to the boiling point of camphor, and a rapid current of air projected over the surface of the pan, blowing the camphor into a condensing chamber, where it settles in the form of snowflake-like crystals.

The subliming pan and its condensing chamber are so arranged that from the time the crude camphor is put in to the time it comes out, human hands do not touch it, but it is transferred mechanically into paper-lined barrels, thus insuring absolute freedom from dust or any extraneous matter or impurities. The yield of camphor by this process is from twenty-five to thirty per cent of the weight of turpentine used. In addition to camphor, there are a number of light oils produced in the process, which are also found in nature, namely, dipentine, oil of lemon, oil of lime, and a number of other natural terpenes and essential oils. The process of synthetically producing camphor takes about fifteen hours. This is the occidental way of doing things.

The Formosa monopoly dates from August 5, 1899, and at that time refined camphor sold in the open market in the city of New York at 43½ cents per pound. In March, 1900, the Japanese government arranged with a London firm for the distribution and sale of the entire camphor production of Formosa. Since the formation of the imperial monopoly the price of camphor has steadily advanced from 43½ cents to 51 cents per pound to December, 1899.

Since the letting of the contract, the price has fluctuated between 55½ and 60½ cents per pound, these quotations being for lots of three hundred pounds and upward. The government pays the natives 12 cents per pound for the standard crude article; and in getting the camphor ready for the market, the government is put to an additional expense of about nine cents per pound. It turns this product over to its London agents or to consumers in Japan at 32 cents per pound for grade B and 35.7 cents for grade A. Considering loss in refining and cost of delivery to jobbers and wholesale houses, plus profits of refiners and middlemen, the price of refined camphor to the consumer is from 55 to 60 cents per pound.

It is not generally known that only about one-fourth of the total amount of camphor consumed in this country is used in medicine; the remaining three-fourths is consumed in the arts, being largely employed in the manufacture of artificial leather, in celluloid, in gun-cotton, in photo-films, etc. Artificially produced camphor, or synthetic camphor, for it is in no sense artificial nor different from the natural wood product, promises to reduce the price of this important drug at least to some extent, and to be a wholesome competitor of the Japanese monopoly in the markets of the world.

In the current issue of the SUPPLEMENT will be found an exhaustive article on the natural camphor industry, in which the industrial features of this monopoly are discussed.

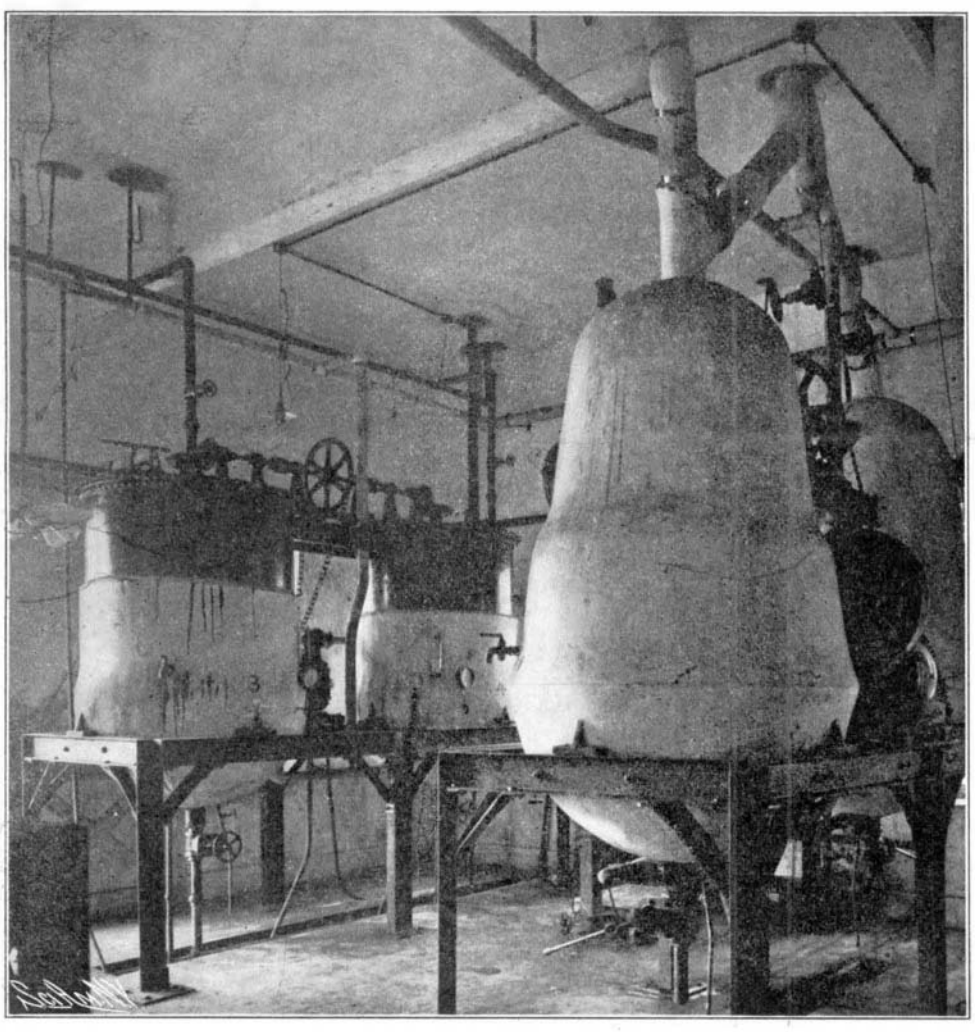

Fig. 1.—ARTIFICIAL CAMPHOR PLANT. TWO SETS OF REACTION TANKS AND STILLS.

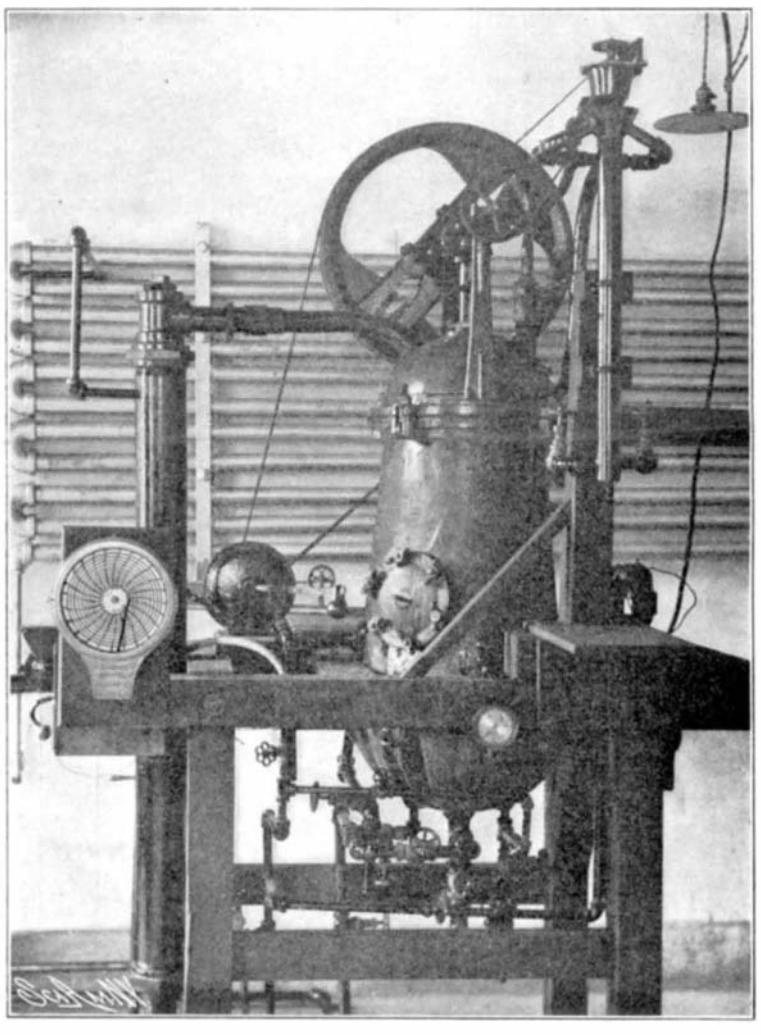

Fig. 2.—COMBINED REACTION TANK, STILL, AND CONDENSER FOR PRODUCTION OF CAMPHOR IN THE LABORATORY.

The Largest Meteor.

The Smithsonian Institution's expert, F. W. Crosby, examined the meteor which fell at Lodi, Cal., and pronounces it not only genuine, but the largest ever found in the United States. It weighs between 10 and 20 tons. From all appearances it seems to have been buried in the hill, where it was found, for many years,