SPONS' ENCYCLOPÆDIA

OF THE

INDUSTRIAL ARTS, MANUFACTURES,

AND

COMMERCIAL PRODUCTS.

DIVISION II.

CONTAINING

BEVERAGES (*continued*), BLACKING, BLACKS, BLEACHING POWDER, BLEACHING, BOGWOOD, BONES, BORAX, BROMINE, BROOM-CORN, BRUSHES, BUTTONS, CAMPHOR, CANDLES, CANE, CARAMEL, CARBON, CARBON BISULPHIDE, CATGUT, CELLULOID, CEMENTS, CHICORY, CHLORAL, CHLORINE, CHLOROMETRY, CLAYS, COAL-TAR PRODUCTS, COCOA, COFFEE, CORK, COTTON MANUFACTURES, &c.

LONDON:

E. & F. N. SPON, 46, CHARING CROSS.

NEW YORK: 446, BROOME STREET.

1880.

which plate is provided with a slot or hole in the centre through which the bow is passed. In the act of fixing the plate or collar on the underside of the button, the button is provided with a recess round the shank, into which the collar is dropped and firmly held by the pressure employed in the construction of the button. A substitute for shanks is composed of metallic prongs of round wire, or cut from sheet metal, secured to the head of the button in the same way as the shank, and varying in number. If preferred, a metallic collar may be used in combination with the prongs and placed outside them. The latter are then put through the collar in the act of fastening the button on the material, and the prongs are turned down within the collar and firmly driven in, as shown in Fig. 459, A and B.

457. 458. 459. 460.

A proposal for doing away with the stiffness in fastening buttons is to have a ball and socket joint, the end of the shank being spherical, and moving in a hemispherical hollow, giving it a certain amount of flexibility.

The last button that will be noticed is that shown in Fig. 460. It is formed as usual, except that the underside is made with a projecting neck, having a hole in the centre. On each side of the neck, is a slot in which slides a catch consisting of a slotted slide piece. The fastener is composed of a stem of metal with a flange or collet at the lower end, the other end being pointed or coned and shaped with a groove at a short distance from the end. The figure shows the underside of the button with the catch; *a*, the underside of the button; *b*, projecting neck; *c*, hole in the centre of neck; *e*, slotted catch sliding in the slots in the neck. The slot *e'* is enlarged at one end, *f* corresponding with the hole *c*. The diameter of the stem of the fastener allows it to pass freely, but without shake, through *c* and *f*.

Seat of the Industry.—The principal button factories are distributed, in about the following proportions, in and around the towns named:—London, 58; Birmingham, 161; Paris, 140; Brussels, 5; Vienna, metallic 15, porcelain 5, shirt 6, silk 11; Prague, several; Berlin, 49; Barmen, 29; Lüdenschied, 14; Elberfeld, 9; Hamburg, 5; Stuttgart, 6; Darmstadt, 3; Offenbach on Main, 3; Lubeck, 2; Breslau, 2; United States, 55, principally in New York (19) and Philadelphia (13). There are also several factories at Lyons, and one at Milan.

As regards the home manufacture, Birmingham turns out principally metallic buttons, and exports large quantities of linen shirt-buttons to France, though unable to compete with her in some other classes. It produces also some few glass buttons, and consumes about 15 to 20 tons of Corozo nut a week, for making vegetable ivory buttons. For pearl button-making, it uses about 2 tons weekly of the best shells, and perhaps 20 tons of the inferior sorts. France manufactures far more buttons than we do. She exports immense quantities of wooden button moulds to this country, and is known for bone, pearl, vegetable ivory, and glass varieties, the chief factories being concentrated in some three or four towns distant 40 to 60 miles north of Paris. A few years since, France enjoyed almost a monopoly for porcelain buttons; but since the destruction of Orleans by the Germans the trade has gone Rhinewards. Germany (including Austria) exports more buttons than France and England combined, supplying the markets of America, as well as those of northern, eastern, and southern Europe. She excels in cheap articles with a good outward appearance. Vienna is known for pearl buttons, eclipsing Birmingham in that branch, and several German towns have taken up the porcelain button-making, which does not seem to have made its way across the Atlantic as yet. Prague is now the great emporium for porcelain buttons. One works there possesses fourteen machines, costing only about 25*l.* each, which turn out individually an average of 1600 buttons a minute. The great bulk of the glass buttons, too, are made in Bohemia, where the cheapness of labour and raw material enables them to produce a good article at an absurdly low figure—about 11*d.* per 20,000, it is said.

Imports and Exports.—The values of the imports of all kinds of buttons, excepting metallic buttons, for the year 1878 were, from Holland, 405,210*l.*; France, 192,236*l.*; Germany, 32,309*l.*; other countries, 3551*l.* The value of all buttons (save metallic) exported from the United Kingdom to all countries, in 1878, was 7222*l.*

(See Bone; Celluloid; Glass; Ivory; Nuts; Pearl and Coral; Pottery.)

CAMPHOR. (Fr., *Camphre*; Ger., *Kampher.*)

The name "camphor" is technically applied to a great number and variety of gum-resins, all of vegetable origin, and possessing more or less similar general characteristics, coupled with minor distinctive peculiarities. Three kinds only are objects of commerce; they are derived from (1) *Laurus camphora* (*Cinnamomum camphora*, *Camphora officinarum*), the well-known camphor laurel of

China and Japan; (2) *Dryobalanops camphora* (or *aromatica*), a gigantic tree inhabiting the Malay Archipelago; and (3) *Blumea balsamifera*. The products are known respectively as Common camphor, Borneo camphor, and Blumea camphor. Each of these will be considered under a separate head; and, at the end of the article, will be added short descriptions of the less-known "camphors" of pharmacy.

Common or Laurel Camphor.—C_{20} H_{16} O. This is a colourless, transparent body, of tough, waxy, structure, having a specific gravity about equal to that of water, melting at 175° (347° F.), and boiling at 204° (400° F.). It volatilizes readily at ordinary temperatures, giving off the peculiar pungent aromatic odour which characterizes it. Recent researches prove it to be a phenol. It is very slightly soluble in water, to which it communicates its warm camphor taste; but in alcohol, ether, fixed and volatile oils, naphtha, aniline, &c., it dissolves with facility. On subjection to the action of oxidizing agents, it is transformed into camphoric acid, and, if the oxidation be continued, camphretic acid, C_{10} H_{14} O_7, will result.

The camphor laurel is a gigantic evergreen, bearing considerable resemblance to the common laurel, except in the matter of size, attaining, as it sometimes does, to a height of 50 ft. and a girth of 20 ft., with branches 8 or 9 ft. in circumference. The leaves are shining, and of a bright green colour, emitting a camphoraceous odour when bruised. The wood is white and fragrant, and is much used by the Chinese in carpentry, as it is proof against the attacks of insects. The chief habitat of the shrub is the island of Formosa, where it reaches the greatest size, and where most of the camphor of western commerce is produced. It also flourishes in China, the Chusan Archipelago, and Japan; the last-named country exporting considerable quantities of the drug. The shrub has now become naturalized in most of the tropical and warmer temperate countries of the world, as in Java, Brazil, Jamaica, and the West Indies generally, Cape of Good Hope, Mauritius, Madeira, and the Mediterranean region; and it has been proposed to introduce it into South Georgia and Florida. It forms a large and handsome tree in sheltered spots in Italy, as far north as the Lago Maggiore; it is commonly found in all the nurseries around Paris, and is not unknown in this country. The drug obtained from this laurel is prepared exclusively, or nearly so, for the markets of the West, and constitutes the only camphor of European and American commerce. As the native processes of collecting and preparing the substance vary in the different countries where the shrub is indigenous, it may be best treated geographically.

1. Formosa.—In the district of this island included under Chinese territory, the camphor laurel is not found; it is confined to the country of the aborigines, and its immediate borders. This circumstance is owing to the fact that the extraction of the camphor entails the destruction of the shrub; as this destruction has never been compensated by replanting, the forest has been gradually cleared away, the aborigines receding and the Chinese encroaching as the work of destruction has progressed. In consequence of the disturbed relations between the two races, thus induced on the border lands, the risk attending the camphor trade is very great, the distillers requiring to be always on their guard against attack; nevertheless, the industry maintains its ground. The method of preparing Formosan camphor is as follows:—The shrubs, as required, are selected for the abundance of their sap, many being too dry to repay the cost and labour of treatment. The best part of the wood is secured for timber; while the branches and refuse are taken, while freshly cut, and chopped up into little pieces for distillation. The stills, built up in sheds and moved as the Chinese advance into the interior, are of very rude construction; over eight or ten hearth fires, is placed a long wooden trough, often a hollowed tree, coated with clay and half filled with water. Boards pierced with holes are fitted on the trough, and above these are placed jars containing the chips; the latter are surmounted by inverted earthenware pots, and the joints are made airtight by means of hemp packing. When the fires are kindled, the generated steam passes up through the pierced boards and, saturating the chips, causes the sublimated camphor to settle in crystals on the inside of the pots, from which it is scraped off, and afterwards passed through a second process of distillation to remove some of the impurities. At the bottom of a copper still, is placed a bed of dry powdered earth from an old wall (selected, doubtless, for the sake of the lime it contains), and on this a layer of crude camphor; this is again covered with earth, and so on alternately till the vessel is full, the series terminating with a stratum of earth, and being finally covered with green mint. A second vessel, usually formed of straw smeared with clay on the outside, is inserted over the still and luted on. The apparatus is placed over a regulated fire, and the contents are heated for a considerable time. After cooling, the camphor is found to have sublimed, and attached itself to the upper vessel.

For transport from the interior, the camphor is packed in large vats or tubs, provided with escape holes at the bottom, and is stowed in carts of rude construction. Through these holes, exudes an oily or uncrystallizable liquid, known as "camphor-oil" (*q. v. post*). Almost all the camphor produced in Formosa is shipped from the free-trade port of Tamsui, at the northern extremity of the island. It is the characteristic export of the place, and one of the most interesting, forming the main supply of the European markets. It is the only commodity, either of export or import, for

which the Transit Pass system is made use of. From Tamsui, the camphor is conveyed by native craft to Hong Kong, Shanghai, or Canton. Hitherto, owing to its being comparatively loosely packed, and containing a large percentage of water absorbed during its sublimation from the wood, the loss caused by evaporation during the journey between the two ports has been very large. The Customs allow for an estimated decrease of 5 per cent. (formerly 11 per cent. was the allowance); but the actual loss often amounts to 20 per cent. Lately, a hydraulic press has been established by one of the foreign firms trading at Tamsui, and the loss has thereby been reduced below the Customs' allowance. Chinese shippers have not yet learnt to appreciate the advantage gained; but it will be strange if they do not soon avail themselves of it. Until 1868, the Chinese Government enjoyed a monopoly of the Formosan camphor trade; but it was then thrown open, with very beneficial results. In 1870 and 1871, attempts were made to re-establish the monopoly, under cover of a tax of less than a ½*d.* per lb., in itself unimportant. With the removal of the objectional features of the impost, merchants have rested content, and things have gone smoothly since.

There is no doubt that the supply of camphor laurels in Formosa is being gradually exhausted, though a number sufficient to satisfy the needs of many years still remains. The seaboard has been stripped of its shrubs; but throughout the mountainous interior, the forests are still untouched. At Posia, a fertile plain among the hills in the middle of the island, Mr. Bullock's party, in 1873, found an abundance of camphor laurels; but the civilized aborigines inhabiting the spot are ignorant of their value. The prices ruling in Formosa, in 1872, gave a profit of 2 to 3 dollars (dollar = 4*s.* 1*d.*) a picul (133⅓ lb.) to the producer. For the western consumer, the Formosan camphor is reshipped, from the Chinese ports mentioned above, in square chests lined with lead-foil or tinned-iron, containing 1¼ to 1½ cwt. each. It consists of small dirty-greyish grains congregated together, their sp. gr. when pure being 0·98 to 0·99. It is always wet, as the merchants cause water to be poured into the cases before shipment, with a view, it is pretended, of lessening the loss by evaporation. The statistics of Formosan camphor production are as follow:—

1870. 17,239 cwt., value in place, 29,080*l.* Of this quantity, 12,368 cwt. were exported, viz.:—to China, 7890 cwt.; Japan, 2576; Bombay, 311; Strait Settlements, 1023; Germany, Holland, and France, 568. The bulk of that sent to Eastern markets was re-exported to the West, the portion which reached England being valued at 45,249*l.*, or an average of 3*l.* 16*s.* 6*d.* per cwt.
1871. 11,537 cwt., value in place, 15,048*l.*
1872. 17,500 „ „ ——
1873. 12,239 „ „ 23,633.
1874. 14,380 „ „ 25,666. Nearly all of this was sent to Hong Kong, and 3556 cwt. were ascertained to have been re-exported.
1875. 8,499 cwt., value in place, ——
1876. (About) 11,700 „ „ ——
1877. „ 17,500 „ „ 23,710*l.* Of which about 2700 cwt. went direct to non-Chinese ports.

The imports of Formosan camphor to this country are about six times as great as those from Japan.

2. China.—An inconsiderable quantity of camphor is produced near Chinchew, in the province of Fokien, on the mainland of China. The method of preparation, which differs from that in vogue in Formosa, is as follows. The freshly gathered branches of the laurel are chopped into small pieces, and steeped for two or three days in water; they are then boiled in a suitable vessel, meanwhile being continually stirred about with a stick, until the grains begin to adhere to it in the form of a white jelly. The fluid is then poured off into glazed vessels, and is left at rest for some hours, when the camphor will be found in a concreted mass. The crude drug is then purified as in Formosa.

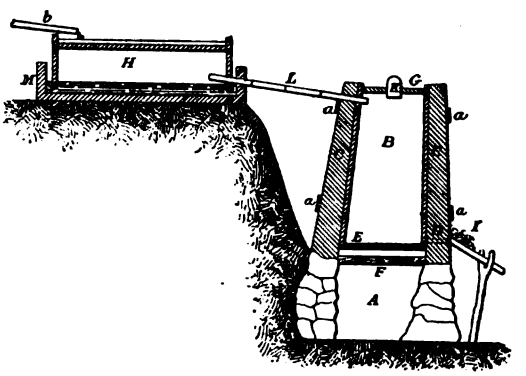
The shrub also flourishes in the Chusan Archipelago, growing to a large size if permitted; the natives, however, only use the wood, and do not extract the camphor as on the main.

3. Japan.—The camphor laurel is widely distributed throughout the three principal islands of Japan. It flourishes best in the southern portion of the empire, viz. in the province of Tosa, in Sikok; the mild, damp sea-air favours its growth here, and the principal preparation of the drug is carried on in this locality. The districts of Satsuma and Bungo also produce considerable quantities; the exports are chiefly from the ports of Osaka and Hiogo, and in much inferior proportions from Nagasaki.

The distillation of the camphor is carried on throughout the year; but the best results are obtained in winter. The workmen choose a space where the trees are abundant, and there build a temporary dwelling and a camphor still. When the patch is exhausted, the buildings are taken down and transported to another locality. The distilling process is very simple; but is much in advance of the methods practised in China and Formosa. A tree is chosen, and as soon as it is felled, the trunk, large

roots, and boughs are cut up into small uniform chips, by means of a short-handled axe, and are drawn in barrows to the still. This is commonly placed on an incline, in the neighbourhood of a rivulet, which will furnish water for the wet distillation of the camphor. The most general arrangement of still and condenser, adopted in the Tosa district, is shown in Fig. 461. On a small circular stone wall A, serving to form a fire place, lies an iron plate F, 2½ in. thick. This is covered by a numerously perforated lid, luted tightly with clay, which at the same time forms the bottom E of the vessel B, which is 3 ft. 4 in. high, and 18 in. wide at the top. Near the bottom is a square opening D, which may be closed by a board. The whole is clothed with a thick coating of clay C, held fast by a binding of bamboo hoops *a*. The upper opening is closed by a clay luted cover G, having a hole in the centre, furnished with a cork K. Just under this cover, a hollow bamboo stem leaves the still, and passes to the condenser H. This consists of a four-sided box open beneath, divided into five intercommunicating compartments by means of four partitions, and turned with its open side into a vessel M containing water. This condenser is kept constantly cool by a stream of water, led over the top by means of the pipe *b*. The distillation is conducted in the following way:—After removing the cover G, the vessel B is filled with the chips of camphor wood, the cover is replaced, and well luted with clay; then through the opening K, a certain quantity of water is run in, which, after saturating the chips, will collect in the pan F. Gentle firing is now commenced, and is continued for twelve hours, so as to keep the water in F at a steady boil. The ascending steam, finding its way among the chips, carries all the camphor with it, and, on condensation in the cooler H, the camphor is deposited. After 24 hours, operations are suspended, the whole apparatus is cleaned out, and the camphor collected in H is removed into tubs. Here it is subjected to very gentle pressure to extract the oil, which amounts to 25 per cent. at least, and is quite limpid. In some districts, the raw camphor is submitted to a second, somewhat stronger, pressure, by which a greater proportion of the oil is forced through the joints of the casks. The two products are then ready for market. The camphor exported is never quite pure; it always needs to undergo a process of purification after arrival in Europe. The waste chips, after drying on the grating I, are used as fuel.

461.



Japanese camphor is distinguished from Formosan by being coarser grained, clearer, of pinker hue, and by subliming at a lower temperature. It is also known as "Dutch," or "tub" camphor, the latter name arising from its being imported to Europe in tubs covered with matting, each placed within a second tub, secured on the outside by hoops of twisted cane. No metal lining is used, and the camphor is thus drier than the Formosan. Each tub holds about 1 to 1¼ cwt. The selling price is nearly twice as high as the Formosan, and the imports to Europe are about as 1 to 6.

The amount of camphor exported from Japan, in 1870, was about 2360 cwt., principally to China (2171 cwt.); Straits Settlements (51 cwt.); and France and Germany (139 cwt.). Its value in the selling market was 14,498*l*., or about 6*l*. 2*s*. 10*d*. per cwt. In 1871, Hiogo and Osaka exported about 8450 cwt., and Nagasaki about 900 cwt. more: the total value was placed at about 25,000*l*. In 1872, the value of the export was stated at 30,576*l*. In 1876, Hiogo and Osaka exported about 10,000 cwt.

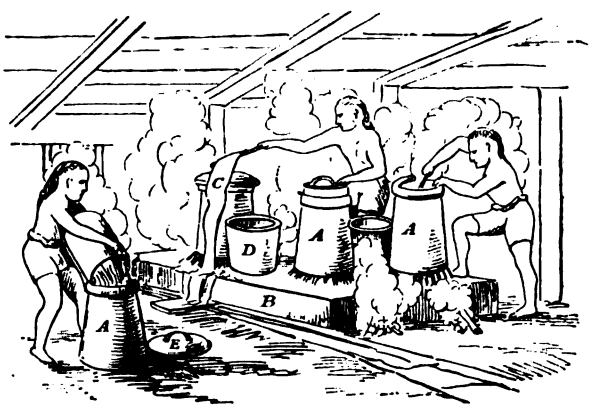
The imports of common camphor into the United Kingdom, in 1870, were:—Unrefined, 12,368 cwt.; refined, 2361 cwt.

Imitations of Common Camphor.—It is said that camphor has been prepared from the roots of the cinnamon shrub, and finds a ready sale in Ceylon and other parts of India; report also states that it has been obtained from several of the *Labiatæ*, notably in Spain. An imitation camphor is sometimes made in Japan; but it is readily distinguishable from the genuine article. An artificial chemical product, bearing a close outward resemblance to camphor, is obtained by passing hydrochloric acid gas through oil of turpentine surrounded by ice. Two compounds are produced: solid artificial camphor, $C_{20}H_{16}HCl$, white, transparent, lighter than water, and possessing a camphoraceous taste; and a liquid known as "terebine." This preparation has not been admitted into pharmacy, and is little more than a laboratory curiosity. It is easily recognised by the reaction with ammonia. If natural and artificial camphor be dissolved in alcohol, the former will

not be precipitated permanently by ammonia, while the latter produces a flocculent precipitate, which is not dissolved in the supernatant liquid.

Refining Common Camphor.—The crude camphor consists of small crystalline grains of greyish-white or pinkish hue, cohering in irregular, friable masses; this, when dissolved in spirits of wine, leaves a sediment of 2 to 10 per cent. of impurities, composed chiefly of common salt, gypsum, sulphur, and vegetable matters. The latter are removed by careful distillation, in the presence of a little quicklime to absorb the oil, &c. Two earthen pots luted together, and having a small aperture provided for the escape of the air on the first application of the heat, answer the purpose roughly. In this way much camphor is refined by the natives of India. They buy it in the cases as it arrives from Chinese treaty ports, paying about 3¼ rupees (rupee = 2*s.*) a *Surat maund* of 42 lb. The process is illustrated in Fig. 462, and is conducted as follows:—About 1½ *maund* of camphor are mixed with 2½ *seers* (*seer* = 1⅔ pint) of water, and placed in a copper still A, about 2½ ft. high. This quantity of camphor is made into a pyramid, and after it is piled into the vessel, an additional 2½ *seers* of camphor (? or water) are thrown in round the sides. A copper lid E is then put on, and, to make it perfectly tight, an iron bar is passed through it and the vessel by holes made for the purpose. The still is then lifted by handles, and set on an earthen *chula* B, below which fires are burning. The lid and edges of the still are smeared with wet clay, which is also piled up into a cone. In about fifteen minutes, steam comes through the hole where the bar goes, whereupon a cloth C attached to a bamboo is dipped into a receptacle D filled with water, and mopped over the clay cone on the still, so that the water keeps the upper portion cool. This is maintained for three hours, when the sides of the still are beaten with a stick. If this produces the sound of an empty vessel, it is known that the process of sublimation is complete; the still is then removed from the *chula*, and the lid is opened. The camphor is found in a thick crust lining the upper part of the sides of the still; it is divided into four pieces by a flat iron knife, and packed in boxes for sale to the dealers.

462



The refining of camphor in Europe was long confined to Venice; but it is now carried on largely in England, Holland, Hamburg, and Paris, the product being much finer and purer than that obtained by the crude processes of the East. In England, the operation is performed as follows:—The impure camphor is broken up, mixed with 3 to 5 per cent. of highly slaked lime, and 1 to 2 per cent. of iron filings. These are well sifted, and introduced through a funnel into the necks of a series of *bombolos*, flasks of thin flint glass, with flat bottoms and short necks, the name being of Venetian origin. These are placed in sand baths, which are heated by dishes of fusible metal, kept at the proper temperature by means of a furnace outside the room. The object of this is to avoid the necessity for bringing fire into the presence of the very inflammable vapour given off by the camphor. When filled and in place, the flasks are covered with sand to the neck, and rapidly heated to 120°–190° (248°–374° F.) for half an hour, to expel the water. The temperature is then gradually raised to about 204° (400° F.), and maintained at this point for about twenty-four hours. As the temperature increases, the camphor softens, and at last melts. When the mass has become fluid, the sand is removed from the upper part of the flask, and a paper stopper is put into the neck to partially close it. The heat is then carefully preserved at a point sufficient to sublime the camphor, but not to remelt it, so that it re-solidifies on the interior upper part of the flask as a semi-transparent cake, leaving all impurities behind. The temperature of the refining room is about 65° (150° F.), the air being very dry, and highly charged with camphor. To diminish the escape of camphor vapour during the process, each *bombolo* is covered with a glass shade; another use of this is to exclude the air, whose presence would make the sublimed camphor opaque instead of translucent. The whole process lasts about forty-eight hours; it requires the greatest attention and experience, on account of the inflammability of the substance, and the necessity for regulating the temperature very nicely, so that the sublimate may be deposited, not merely in loose crystals, but in compact cakes. When the sublimation is completed, the flasks are taken out, and cold

water is sprinkled on them. This causes them to break, and the now pure camphor is removed from them in the form of large bowls or concave cakes, like gigantic quoits, about 10 or 12 in. in diameter, 3 in. thick, and weighing 9 to 12 lb. The *bomboloes* weigh about 1 lb. each, and measure about 12 in. across. Sometimes a little charcoal or sand is added to the lime, and, when sulphur is present, iron filings are a useful adjunct.

Following is an account of the Dutch method of purifying. To every pound of camphor, is added about 2 oz. of lime; the two are well mixed in a mortar or small mill, and about ¾ lb. of the mixture is put into each still. These consist of black glass flasks of round form and with long necks, a certain number being placed in a row on sand baths heated by a furnace beneath. They are buried some inches in the sand, and tightly stoppered with cotton or tow. Under each sand bath is a furnace and ashpit. To commence with, a gentle fire is made so as to liquefy the camphor. The steam rises into the neck, and would condense and fall back into the still in drops if it were not prevented. Each still is furnished with a conical hood or cap of tinned iron, which is covered with warm sand, and in which the vapour collects. In this way, all danger of breaking the still, by drops of camphor falling back, is avoided. When the camphor is fluid enough, and all the moisture has been eliminated from it, the sand is removed from the hood, or the latter is replaced by another, having a hole in the middle, to admit an iron implement for stirring up the mass in the still. As the camphor evaporates, it condenses again on the sides of the cap, and there forms a transparent mass. All outer air must be rigidly excluded. When the hoods have been exchanged, and the moment the sublimation begins, the fire is reduced. The temperature is maintained at the proper degree for a whole day. From time to time, the workman removes the cap and the cotton stopper, in order to stir up the stuff at the bottom of the still with an iron tool, and to keep the passage of the neck open, as the condensing camphor has a tendency to choke it up. Towards the end of the operation, the cap is altogether removed. The end is known to have arrived when the camphor collected on the sides begins to melt. The flasks are then taken from the sand-baths, cooled and broken, to extract the mass of camphor; this is then wrapped up in blue paper. Much camphor still remains in the fragments of the flasks, and as it would be too troublesome to scrape it off, the pieces are thrown into a very deep copper still, which is covered with a circular copper hood, and placed over a fire. The camphor collects as before around the hood, and is then easily removed. During the sublimation in the flasks, the temperature is maintained at 120° 248° F.) for half an hour, and is then raised to 190° (374° F.); at this point, the neck will be coated with moisture, which must be removed by inserting a sponge on a flexible stick. A temperature of 190° to 196° (374° to 385° F.) will melt all the camphor in three and a half hours. The residue is sublimed in a cast-iron vessel, and the little product obtained is thrown in with the next lot of raw camphor.

Uses.—The applications of common camphor are restricted almost solely to medicinal and antiseptic purposes.

Borneo Camphor; Malay Camphor; Borneole; Camphyl Alcohol; or **Kapur Barus.**—This is quite distinct from the camphor of western commerce. It is expressed by the formula C_{20} H_{18} O_2, or two additional equivalents of hydrogen. It fuses and boils at higher temperatures than common camphor, is harder and more brittle, of greater specific gravity (1·009), less volatile, and does not crystallize on the interior of a bottle when kept. Its crystals are coarse and resinous looking, about ¼ in. broad on the faces, and of different form from the ordinary drug. In the chief feature, viz. aroma, it closely resembles common camphor, but is less pungent.

It is the product of a magnificent forest tree, the *Dryobalanops camphora*, or *aromatica*, which often reaches a height of 90 or 100 ft. to the first branches, overtopping all its neighbours, and presenting a handsome head of dense foliage. The trunk often attains a girth of 17 to 18 ft. According to the natives of the Malay Archipelago, there are three kinds of this tree, named respectively *mailanguan*, *marbin tungan*, and *marbin targan*, from the outward colour of the bark, which is sometimes yellow, sometimes black, and often red. The bark is rough and grooved, and overgrown with moss. The leaves are dark-green, oblong-oval, and pointed; they smell of camphor, and are hard and tough. The exterior form of the fruit is very like the acorn; but it has around it five petals, placed somewhat apart, and the whole much resembles a lily. The tree flourishes to greatest perfection between the altitudes of 250 and 400 ft. above sea level; but is also found in dry (that is, not marshy) places near the sea coast, and rarely at an elevation of 1000 ft. Its chief habitat appears to be the extensive bush of the Batta country, on the west coast of Sumatra, north of Ayer Bangie; it is also found in the mountains of Santubong, Marang Sundu, and Sugony; in Labuan; in all the northern parts of Borneo, and it is said to be particularly abundant in the country of the Kyans, on the upper reaches of the Bintulu and Rejang rivers.

The camphor is secreted, in the form of coarse crystals, in the hollows and interstices of the body of the tree, especially in the knots, and swellings of the branches from the trunk; but it is not found in every tree, some observers remarking that only about one tree in a thousand appears in a condition favourable to the secretion of the gum. The natives have no means of estimating the

quantity of camphor in a tree, and though they know that it increases with age, the latter is always an element of uncertainty with them. Trees in a state of decay often contain the most camphor. The drug is gathered at irregular intervals, according to the fancy of the Rajah on whose territory the trees are. About thirty men start into the forest; select a place where the trees are most numerous; and build rude huts, which sometimes form their dwelling for months together. They divide into two parties, one felling the trees, the other extracting the camphor. The tree is cut down just above its roots, divided transversely into several logs, and these again are split with wedges into small pieces, from the crevices of which the camphor, if there be any, is extracted. That which comes away readily in large, semi-transparent flakes is esteemed the prime sort or "head"; the smaller clean pieces are considered as "belly"; and the minute particles, chiefly scraped from the wood and often mixed with it, are called "foot." The last is separated from its impurities by steeping it and washing it in water, sometimes with the aid of soap. It is then passed through sieves or screens of different meshes, in order to make an assortment as far as regards the size of the grains; but much of the selection is also made by hand, and particular care is taken to distinguish the better kinds from that produced by the artificial concretion of the essential oil. The quantity of camphor yielded by a single tree probably averages about 10 lb. Its commercial name is *Kapur Barus*, the first word signifying camphor, and the second being the name of the Sumatran port whence this article is mostly shipped; it is sometimes called "bamboo camphor," from the fact of its being transported from the interior in hollow stems of that plant. It is in such great demand among the Malays and Chinese for embalming their dead, that it is only met with in Europe as cabinet specimens, the whole produce being consumed *in loco*. Thus the Chinese export to us their own Formosan product, while they import *Kapur Barus*, paying as much as 12*l*. 10*s*. a *catty* (1⅓ lb.) for the best quality.

The production of the drug is lessening yearly, and the profitable operations of 1753, when fully 1250 lb. were shipped from Padang, will probably never return. Trees are cut down at random without any being replanted, and this wilful and wasteful destruction will, it is feared, soon place the tree among the past species of the Archipelago. Propositions have been made to Government to have regular plantations formed in suitable localities (as is done with the teak tree in Java), notably in the district of Ayer Bangie, Ran, and Tapanolie Residence. The plants, four to six days old, may be transported in boxes half filled with wet sand, the contents being kept carefully wet and covered over with linen.

The tree yields several products besides the camphor. First may be cited the well-known camphor oil (*q. v. post*). The fruit, when fresh and well ripened, is eaten by the natives. The height of the tree prevents the fruit being gathered, but when it falls—in March, April, and May—the people go out to collect it. Prepared with sugar, it forms a very tasty preserve. It is said to be very unhealthy to remain near the tree during the flowering season, on account of the extraordinary hot exhalations given off by it. The wood of the tree is very tough and durable, and much valued by the natives for ship-building purposes. Its strong camphoraceous odour guards it against the attacks of the *kepang*, the destructive worm of those seas. It is adapted to making planks, beams, keels, stringers, and timbers, and has been proved invaluable for wharves and jetties. From its oiliness, it takes fastenings well, and iron is not liable to rust in it. Its weight is said to be about 70 lb. per cub. ft. At Johare, large steam saw-mills have been erected for the purpose of preparing the wood for export.

The following meagre statistics are all that can be found regarding this camphor:—The quantity imported into Canton, in 1872, was stated at 3159 lb., worth about 80*s*. a lb. In 1872–3, 2 cwt. were imported into Bombay, valued at 914*l*. The value of the production in

1873 was £1043	1875 was £3179 (about 5 cwt.)
1874 „ 2578	1876 „ 2337

Blumea, or Ngai Camphor.—A third variety of camphor is manufactured in China from the *Blumea balsamifera*, a tall herbaceous Composita called *Ngai* in Chinese, and abundantly distributed throughout tropical Eastern Asia. When in a crude state, the drug appears in dirty-white, crystalline grains, contaminated with vegetable remains; when pure, it takes the form of colourless crystals an inch long. It resembles the Bornese camphor in every particular, excepting in optical properties. Its value is about ten times that of Formosan camphor, and on this score it occupies an intermediate place between the two principal varieties of camphor. It is quite unknown in Europe; but in China it is much used, partly for medicine and partly for preparing the fine Chinese inks. The manufacture of this kind of camphor is carried on principally at Canton, the exports from which place are valued at 3000*l*. per annum.

A camphor-yielding plant which is closely allied to the preceding, if not identical with it, is the *Blumea grandis*, a native of the Tenasserim provinces, where it flourishes exceedingly, and grows to a height of 6 or 8 ft. Its leaves resemble those of the mullen, and, when bruised, emit a strong camphoraceous odour. Many years ago, the Tavoyers informed Mr. Mason that they were in the habit of making an impure camphor from the weed by a very simple process. Latterly, this has

been improved upon by an Englishman, and the article has been brought into public notice. More than 100 lb. of it were refined and sent to Calcutta, and could not be distinguished from Chinese camphor. The plant is so abundant in the Provinces that they might supply half the world with camphor; wherever trees are cut down, this weed springs up.

Other Camphors.—Besides the three principal camphors of commerce, the following are more or less known in perfumery and pharmacy, viz.:—

Barosma Camphor.—The leaves of *Barosma betulina* yield on distillation about 1½ per cent. of a volatile oil, which solidifies on exposure to cold, and, after re-solution in alcohol, forms needle-like crystals, possessing a nearly pure peppermint odour.

Bergamot Camphor, or *Bergaptene*, is a product of the bergamot tree, a member of the *Citrus* genus, cultivated principally at Reggio, in Calabria. From the full-grown but still unripe fruit, gathered in November and December, an essential oil is expressed. For a period of some weeks after its extraction, the oil gradually deposits a mass of white greasy matter, which, when distilled with water, produces bergamot camphor.

Cinæbene Camphor is obtained from the essential oil of a variety of the wormseed, which grows especially about the Don and Volga, and in the Kirghiz deserts.

Cubebs Camphor, or *Hydrate of Cubebene*, is a deposit formed in cold weather from the oil of cubebs.

Neroli Camphor.—The fresh flowers of the bitter orange, when distilled with water in copper stills, yield an essential oil, most of which passes over on redistillation: the addition of an equal quantity of alcohol to the portion remaining in the still causes a little Neroli camphor to collect on the surface. By re-solution in boiling alcohol, it can be produced in a crystalline form.

Orris Camphor is the solid crystalline substance obtained by the distillation of orris root with water.

Patchouli Camphor.—The substance known in perfumery and pharmacy under this name is homologous with Borneo camphor. It is solid; fuses at about 54° (130° F.), and boils at 295° (563° F.); its specific gravity is 1·051 at 4° (40° F.); it is insoluble in water, but readily soluble in alcohol and ether; it crystallizes in hexagonal prisms; finally, it is a left-handed rotary substance, while Borneo camphor is right-handed.

Sassafras Camphor is yielded as a crystalline deposit, by cooling, in a freezing mixture, the volatile oil procured from the roots and bark of the sassafras shrub of America.

Thyme, Camphor of, or *Thymol*, is a crystalline product of the fractional distillation of essential oil of thyme.

Tobacco Camphor, or *Nicotiania*, is produced by distilling tobacco leaves with water.

Camphor Oils: *a.* Malayan.—During the collection of the camphor from the Malayan camphor tree, that is while the tree is being cut up, an oil drips from it in considerable quantities. Sometimes it is obtained also by tapping the living trees; but is not considered of sufficient value to warrant the destruction of the tree. The method of gathering this oil, as practised by the natives of Sumatra, is to make a transverse incision in the tree to a depth of some inches, the cut sloping downwards so as to form a cavity of the capacity of about a quart. In this, a lighted reed is placed for about ten minutes, and the hole is left for the night, when it becomes filled with the oil. This volatile oil, known as *Borneen*, holds in solution a resin, which, after a few days' exposure to the air, is left in a syrupy state. It is probably camphor in an undeveloped state, as the tree would yield camphor if left. It is seldom brought to market, probably because the price obtained is not a sufficient remuneration for the trouble of transport. Whenever it is offered at Barus, the usual price is a guilder (1*s.* 8*d.*) for an ordinary quart bottleful.

b. Formosan.—This is a yellowish brown, oily, or uncrystallizable camphor, which exudes from the cases of crude common camphor, to the extent of 3 or 4 per cent. It is very strong smelling, and holds in solution an abundance of common camphor, which it speedily deposits in crystals when exposed to a low temperature. Its symbol is $C_{20}H_{16}O$; its density is 0·910. By exposure to oxygen, or the action of nitric acid, it absorbs oxygen and becomes solid camphor. It is much used by the Chinese as an embrocation, especially in rheumatic diseases, and will probably soon be a valuable European import as a cheap substitute for *Lin. Camphoræ*. It is scarcely saleable on the spot, and is considered much inferior to the Malayan camphor oil, from which it is distinguished by an odour of sassafras. In Japan, the oil is expressed from the camphor, and is employed as a lighting material by the very poor people, who are content to burn it in open lamps, in spite of its powerful odour and heavy smoke. A recent native Japanese paper says that a resident at Osaka has built a large factory for preparing this oil,—not for making oil out of camphor, as *Nature* says—which has proved superior to kerosene, both in cheapness and illuminating power.

(See Drugs; Inks; Oils; Perfumes; Resinous Substances.) C. G. W. L.

CANDLES. (Fr., *Bougie*; Ger., *Kerze, Licht.*)

The use of wax candles as a source of artificial light dates from the middle ages, though, from the costliness of the material, it was probably confined, for a long period, to the dwellings of the