In the earlier days of the Norwegian Antarctic whale fisheries every factory ship was its own tank transport, remaining at the whaling grounds only until its tanks were filled and then proceeding to its market port. More recent practice inclines toward providing the factory ship with settling and reduced-volume storage

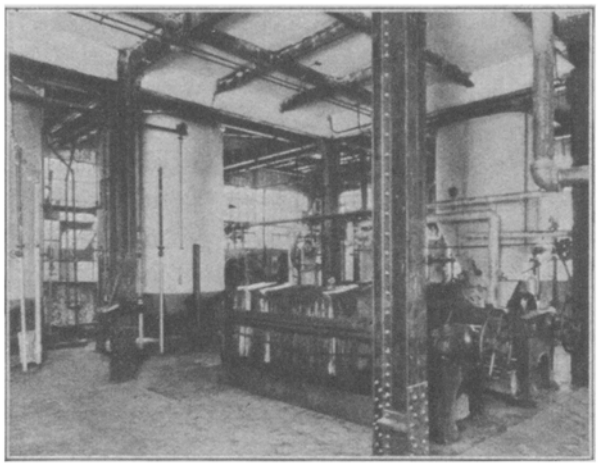

Illustration of refinery apparatus

tanks only, and providing a separate tank steamer to proceed rapidly to market as soon as filled, the factory ship remaining at the whaling station for longer periods to continue the killing and rendering work.

Before the discovery of hydrogenation, and to a much lessened extent since, whale oil has been grained and pressed for the removal of the palmitine (so-called "whale stearine"). The cold pressed whale oil thus produced provided a less smoky illuminant than the whale oil and had also more desirable properties as a leather dressing and lubricant. The methods generally employed for this cold pressing were and still are crude and wasteful of materials and labor in most cases.

> Whale oil constituted approximately five per cent of the world's available supplies of all fats during the 1930-31 season.

The oil is grained in barrels or tubs and transferred to bags for pressing in screw or lever presses. Slackening of demand for the cold-pressed oil will preclude, in all likelihood, the adoption of more economical methods for this purpose. The methods in use for production of winter cottonseed oil would seem ideally suited for application to the cold-pressing of whale oil.

The discovery of the practical possibility of catalytic hydrogenation of unsaturated fats opened to whale oil many fields of industrial application. The fact that whale oil is free from an excessive amount of acids containing twenty or twenty-two carbon atoms makes it, when hydrogenated, a soap-making material superior in quality to hydrogenated fish oils. The better grades of whale oil, when properly refined, and hydrogenated, furnish a suitable fat for use in margarines or shortenings.

Ceylon--Citronella Producer

(*Assistant Trade Commissioner Wilson C. Flake, Calcutta, India, and other sources.*)

Ceylon, a British island colony in the Indian Ocean about the size of the state of West Virgina, is an important source of essential oils and natural aromatic raw materials, particularly citronella, cinnamon bark, and cinnamon leaf oils. Renowned for centuries as a spice center, this island, although now somewhat less prominent as a source of such tropical products, still ships substantial quantities of cinnamon and cardamons and maintains a small trade in nutmegs, mace, and cloves. Certain quantities of cinnamon bark, cardamon, nutmeg, and mace oils are distilled from Ceylonese spice materials in foreign industrial centers which indirectly supplements essential oil supplies from that source.

Citronella Oil

Citronella oil, the principal essential oil contributed by Ceylon to world trade, is obtained by distillation from a coarse grass (*Cymbopogon nardus*) found mainly in the southwestern sections of the island. It grows to a height of about four feet and thrives in dry regions on hard gravelly soils. Successful cultivation of this oil-yielding grass in Ceylon has been attained in areas below an elevation of 1,000 feet.

At higher elevations, growth in certain areas was good, but the yield of oil was low.

Two species of *"Cymbopogon nardus"*—Maha-pengiri, which requires replanting after two years, and Lena-batu, were at one time cultivated on the island, but Maha-pengiri has gradually disappeared and production is now confined mainly to Lana-batu. Generally there are about 40,000 plants to the acre but better results have been obtained by limiting the number to about 15,000.

Harvesting Citronella Grass.—The first cutting of the grass usually is made six months after planting and then every third or fourth month, depending on the weather. The maximum yield is obtained in the third year; after the fifth year, the yields diminish rapidly. In the third year the quantity of grass cut may be 15,000 to 20,000 pounds per acre yielding on an average approximately 60 to 80 pounds of oil or 40 to 50 "bottles" of 24 ounces each. At this stage the oil content of the grass is 0.4 per cent and the average annual yield for the first three years has been estimated at about 45 bottles per acre compared with about 26 bottles from the fourth to the fifteenth year.

The grass is cut at all times of the year, but the yield varies with the season, being highest during the hot period, usually in March and April and low during the wet season and flowering period. The October-November crop is higher in unit weight, but lower in oil content, owing to the flowering.

After cutting, the grass should be left to wilt for a day but care must be exercised to prevent fermentation. The oil obtained from this partially dry grass is more fragrant and of better quality than that obtained from grass distilled immediately after cutting.

Distillation of Citronella Oil.—The oil is distilled by steam. The stills in a typical distillery, usually two in number, are from six to nine feet high and from three to six feet in diameter. After the still is tightly filled with grass, the lid is fastened on and steam let in at the bottom. The steam passes up through the grass, carrying off the oil through a water-cooled coil. The distillate consisting of water and oil is collected in copper tanks about three feet in diameter and 18 inches deep. When the tank is nearly full a siphon attachment begins to discharge the water in the lower level of the tank. The oil, which is lighter, floats and, when a quantity has been collected, is drawn out into bottles or drums. Drums having capacities of 442 pounds, 560 pounds, 784 pounds, and 1,120 pounds are usually employed in packing export shipments of Ceylon citronella oil.

Production and Consumption of Citronella Oil.—The production of citronella oil in Ceylon is in the hands of people who, individually, have little capital and whose output of oil is relatively small. There are many small distilleries, which are not important enough to export direct. In 1930, official estimates place the total number of distilleries in operation at 422, of which 233 were located in the Hambantota district, 182 in the Matara district, and 7 in the Galle district. The small distiller, who may have only a few bottles of oil to dispose of, generally sells to a native dealer in Matara, a small town on the southwest coast which is the "first hand" center. The native dealer then takes the accumulated oil to Galle where it is sold to one of the large exporters established there.

Very little citronella oil is consumed in Ceylon, so that export statistics represent fairly accurately trends of production. The volume and value of the Ceylonese citronella oil trade from 1922 to 1931 are shown in the table below:

Year	Pounds	Value
1922	1,299,889	$475,070
1923	1,121,271	660,388
1924	1,433,381	941,213
1925	1,415,639	824,705
1926	1,431,351	647,629
1927	1,358,191	461,632
1928	1,200,001	382,008
1929	1,183,239	443,975
1930	1,213,542	484,185
1931	1,203,482	314,000

Export shipments radiate to practically every section of the world, significant direct trade being carried on with over 30 foreign countries. The oil destined for Europe is shipped through the port of Galle which has direct steamer connections with leading ports of that Continent. There is no direct service between Galle and the United States and oil for the American market must be sent to Colombo, 70 miles distant, for

(Continued on next page.)

dispatch, or transshipped in Europe—the usual practice being to ship from Colombo on direct boats to New York.

The table below shows the leading markets for Ceylon citronella oil during the last three years:

Country	1929 Pounds	1930 Pounds	1931 Pounds
United States....	415,121	467,972	391,166
United Kingdom.	306,050	282,897	278,200
Germany	136,564	145,206	135,828
Netherlands	58,870	43,629	88,298
Australia	73,639	62,038	61,334
India	32,250	66,789	71,542
Argentina	20,869	24,797	46,939
France	28,393	20,830	25,099
Italy	31,925	35,419	30,039
China	13,534	1,900	11,303
New Zealand.....	6,286	5,279	12,389
Canada and Newfoundland	4,583	11,322	11,203
Other countries..	.....	.....	.....
Total	1,183,239	1,213,542	1,203,482

Market Factors—Purchasing Methods.—Unlike crops which must be planted annually, citronella grass production is not subject to great variations from year to year. However, prices for the oil may influence the small grower to make additional plantings or harvest more of the grass, particularly when quotations for citronella oil make the grass crop more attractive than others. The average price of the oil was 1.06 rupees per pound in 1929 and 1.12 rupees in 1930. (In 1929 and 1930, the rupee was worth about $0.365 United States currency.)

Practically all citronella oil exported from Ceylon is handled by three Galle firms, with connections in Colombo. Some oil is occasionally shipped by other Colombo exporters but the quantity involved is relatively unimportant. The Galle exporters prepare the oil for shipment abroad and test every lot as it comes from the distillery or small dealer. Buyers abroad have, at times, endeavored to purchase direct from the distilleries, but such efforts are usually made by importers who do not fully understand the organization of the citronella oil industry in Ceylon. First, it is unlikely that any one distillery would have at a given time enough oil to make a substantial export shipment. Second, the business is carried on by cable between the exporter in Ceylon and the buyer abroad; the distiller usually does not have the knowledge and facilities necessary to handle this foreign business. Third, by purchasing from a reputable exporter in Galle or Colombo, the buyer abroad is making sure that the oil does not contain excessive adulterants.

Exports and Stocks of Palm Oil and Palm Kernels

Nigeria, April, 1932.—The following information contained in a cable from Vice Consul Willson at Lagos shows exports of palm oil and palm kernels from Nigeria during April, 1932, and stocks on hand at river mouth ports at end of April:

	Exports		Stocks—April 30	
	Palm Oil Tons	Palm Kernels Tons	Palm Oil Tons	Palm Kernels Tons
Lagos	1,400	9,000	1,200	8,800
Koko & Sapele	100	2,900	3,600	1,900
Warri	500	1,800	3,000	1,700
Burutu and Akassa	1,900	2,400	4,600	4,100
Degema	2,300	2,200	5,700	3,900
Port Harcourt	2,100	4,200	5,100	2,500
Bonny, Opobo and Calabar.	2,000	5,700	4,600	1,000

Cod Liver Oil and Common Cod Oil Exports from Newfoundland

According to information received in a report from Consul General Dow at St. Johns, Newfoundland, exports of cod liver oil for the period, January 1 to May 6, inclusive, totaled 4,424 gallons this year, as compared with 16,896 gallons during the corresponding period of 1931; 218,640 gallons and 206,466 gallons of common cod oil were exported for the same period in 1931 and 1932, respectively. Production both of medicinal cod liver oil and common cod liver oil decreased. Prices for cod liver oil remained firm, with a fair demand for this product, while the price of common cod oil was the lowest in 1931 for many years past. The United States, during the latest fiscal year ended March 31, 1932, about three-fourths of each of these products.