

The practical grocer : a manual and guide for the grocer, the provision merchant, and allied trades / by W.H. Simmonds ; with contributions by specialists, trade experts, and members of the trades ; illustrated by a series of separately-printed plates.

Contributors

Simmonds, W. H
University of Leeds. Library

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THE PRACTICAL GROCER



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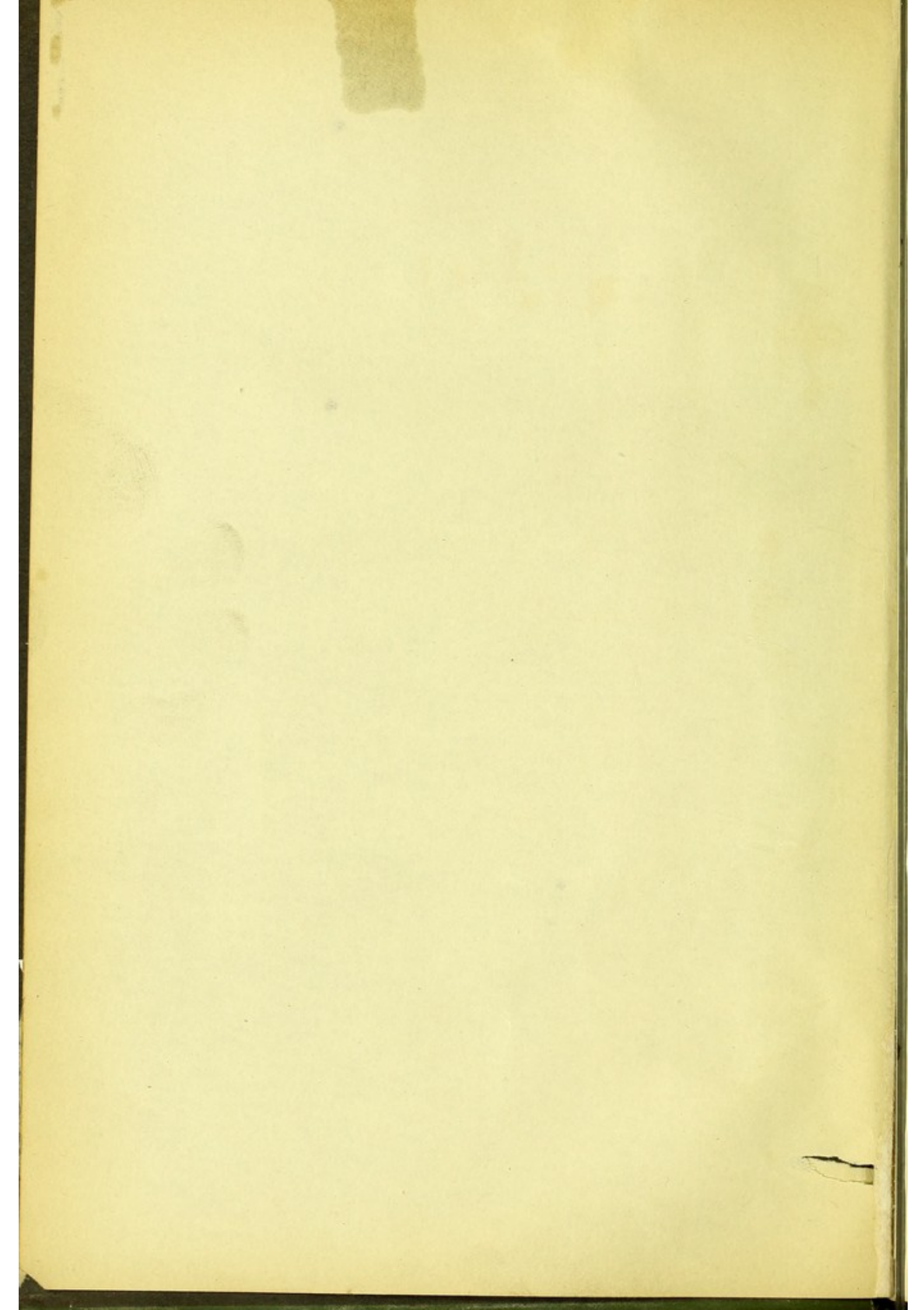
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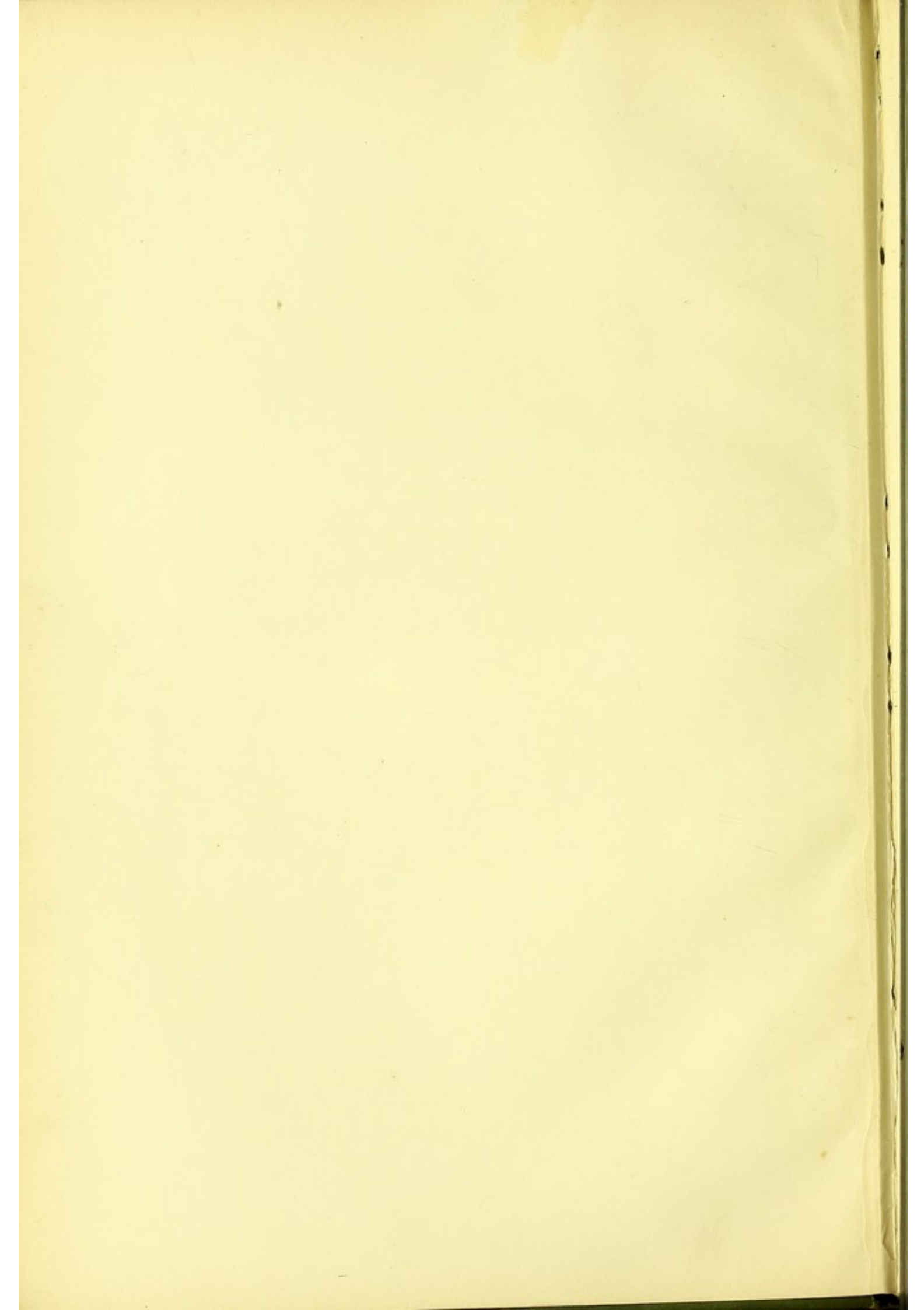
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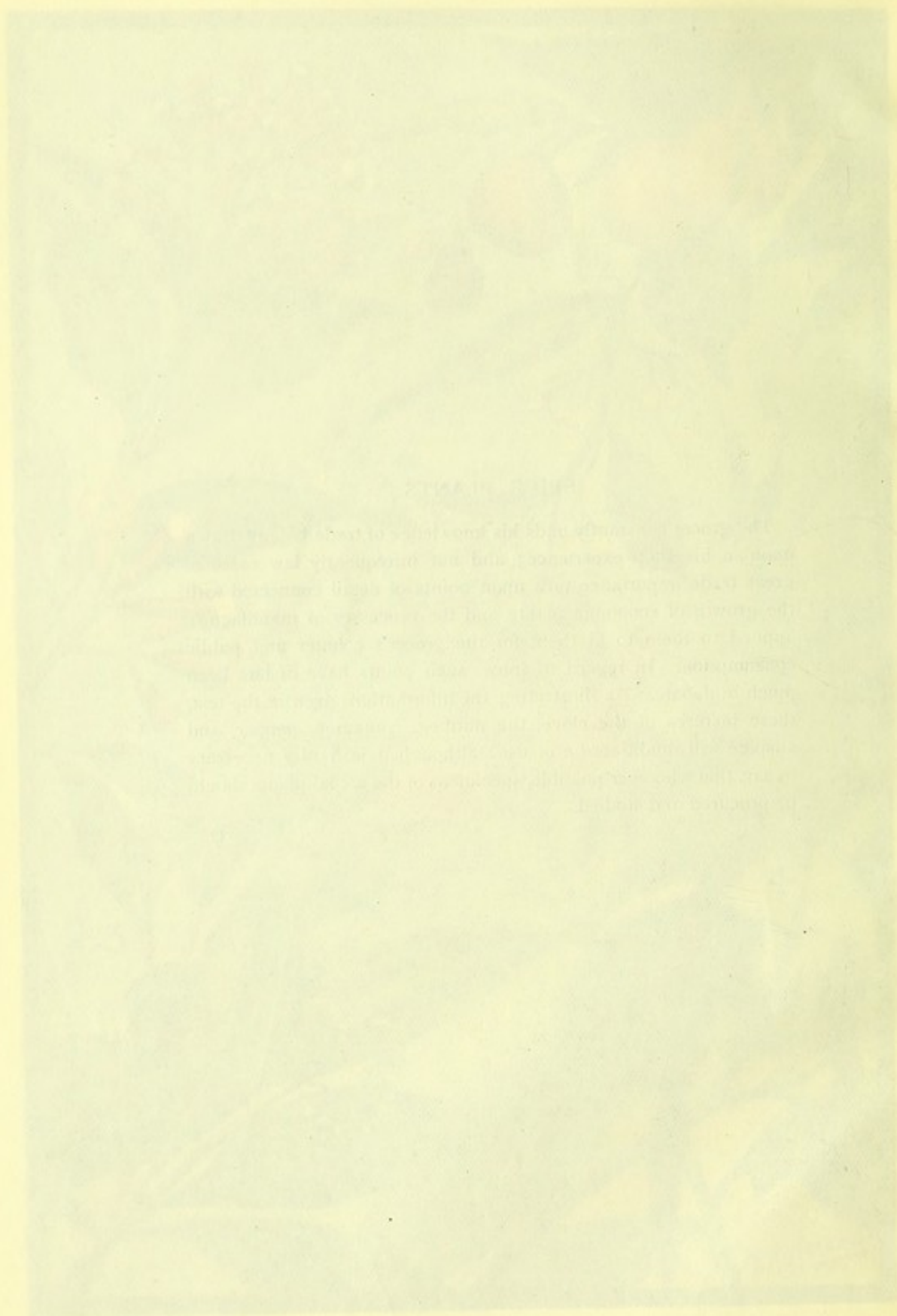
SPICE PLANTS



1. Clove. 2. Nutmeg. 3. Cinnamon.
4. Black Pepper. 5. Allspice or Pimento.

SPICE PLANTS

The grocer constantly finds his knowledge of trade botany drawn upon in his shop experience; and not infrequently law cases of great trade importance turn upon points of detail connected with the growth of economic plants, and the processes of manufacture applied to them to fit them for the grocer's counter and public consumption. In regard to spices such points have of late been much in debate. As illustrating the information given in the text, these pictures of the clove, the nutmeg, cinnamon, pepper, and allspice will doubtless be of use; although it is hardly necessary to say, that wherever possible, specimens of the actual plants should be procured and studied.



THE PRACTICAL GROCER

A Manual and Guide for the
GROCER the PROVISION
MERCHANT and Allied Trades

BY
W. H. SIMMONDS

With Contributions by SPECIALISTS
TRADE EXPERTS and Members of
THE TRADES

Illustrated by a Series of Separately-Printed Plates

VOLUME TWO



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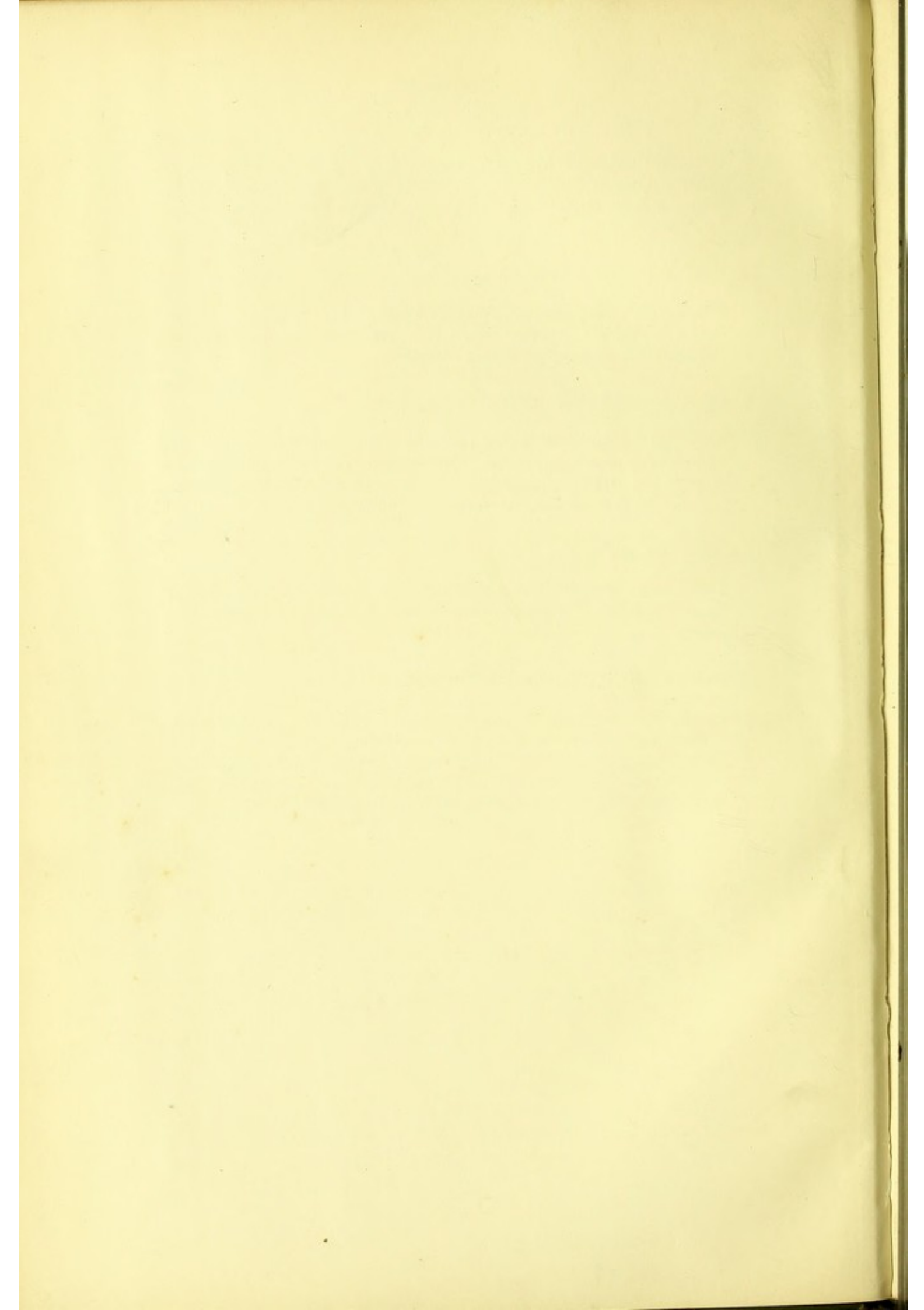
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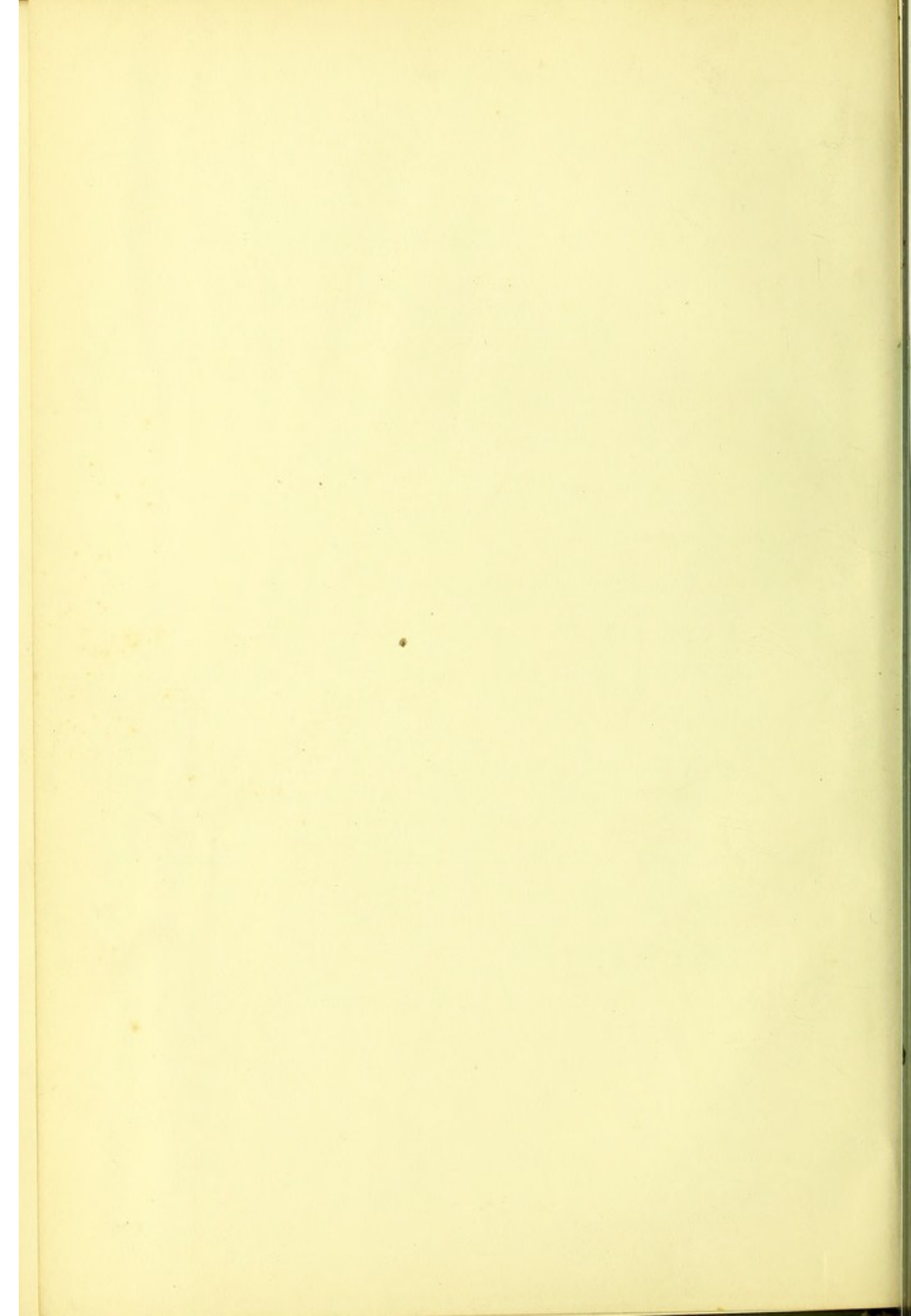
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SUGAR WEIGHTS AND MARKS

THE FOLLOWING ARE THE MORE IMPORTANT
RECOGNIZED MARKS OF FOREIGN REFINED
SUGARS. (See "SUGARS", Vol. II, p. 142, *et seq.*)

Marks of German Granulated. — Bonart, C.F., C.R.M., D.V., E.C.H., F.M.S., G.D., Glauzig, Groeningen, Grasso, Hansa, J.B.R., J.H., O.F., R.A.C.L., R.A.V., S.P.R., Star, Z.H., Z.A., Z.A.F., Z.R.B., Z.R.D., Z.R.M., Skene, and G.S.F.

Marks of French Granulated.—Lebaudy's R.P., and A.T. Wholesale dealers sometimes mark the foreign sugars they sell with the initials of their own firm.

Marks of Cubes.—*German*—Hansa, C.Z.R., A.S.P., S.P.R., F.K.L., A.C.L., S.Z.G., Z.R.D., F.M.S., R.A.V., Meyer, and X.L.R. *Dutch*—S. and T., and W.S.R. *French*—Say's, Lebaudy's, E.S., R.P. *Belgian*—R.T. and R.B., Super. *Austrian*—C.Z.F., T.T.V., and T.T.D.

Marks of Cut-loaf and Loaves.—*German*—C.Z.R., A.C.L. *Dutch*—W.S.R., S. and T. *Belgian*—M.F.

Marks of Crushed Sugar (in bags).—*Dutch*—W.S.R., and S. and T. *Austrian*—T.T.V., T.T.D., and E.S. *Belgian*—R.B., Super.

Marks of Crystals.—*Dutch*—W.S.R. *German*—A.S.P., S.Z.G., E.A.R., A.Z., R.F., and S.P.

Marks of Caster Sugar.—*German*—Skene, A.S.P., R.A.V., and X.L.R.

THE PRACTICAL GROCER

GROCERIES AND SPICES

I. SOURCES OF SUPPLY

To pass in review the sources of supply of the various goods treated of in this section of our work is to survey the world, not merely "from China to Peru", but from Orient to Occident and from Pole to Pole. For its cereals, groceries, and spices are the main foods of the world, and to that vast food-supply, without which Man himself would disappear, the bounty of the Creator has ordained that all countries shall contribute. So universal is now the net-work of trade, so speedy the means of intercommunication, and so effective the means of preserving perishable foods from decay during transportation, that the world's market draws supplies from practically every nook and corner of the globe, few indeed being the parts of the earth's surface so barren or so remote as to yield nothing whatever to the general stock.

Our special concern is with the exporting sources of food-supply—those countries which while supplying their own needs, or part of them, in certain goods, have a surplus of those goods for disposal and distribution through that grand system of which the British wholesale and retail grocers are members. No British grocer should be ignorant of the fact that British shipping, British merchants, and British distributors are the means whereby the principal markets of the world's goods are carried on. For the surplus agricultural produce of exporting countries the United Kingdom is far and away the principal market. The products of agriculture sent to this market from all sources in a single year represent a value of some three hundred millions of pounds sterling. To this remarkable aggregate the United States is the

principal contributor, sending hither nearly one-third of the total. Our own possessions and dependencies—that part of the British Empire outside the United Kingdom—contribute about 24 per cent of the supply, and about 43 per cent comes from foreign countries other than the United States. Of these agricultural imports about 60 per cent are articles of food, the rest being raw materials and feed stuffs for live stock. In 1903, which may serve our purpose as a specimen year, the United Kingdom paid for imported foods some £228,000,000, the United States supplying about 30 per cent, outlying British possessions 20 per cent, and foreign countries other than the States the remaining moiety. The sources of supply of some of the chief articles imported by grocers and provision dealers were:—

	Foreign. £	Imperial. £		Foreign. £	Imperial. £
Corn, rice, flour, &c. ...	55,338,514	15,171,635	Sugar, {beet unrefined {cane	3,726,216 1,146,258	— 622,315
Bacon ...	11,927,377	1,691,763	Dried fruit ...	2,658,703	3,316
Hams ...	2,618,032	524,542	Spices ...	183,231	666,610
Salt pork ...	296,316	22,940	Sauces and con- diments }	38,360	9,130
Rabbits ...	278,396	445,485	Pickles, &c. ...	109,269	573
Canned meats, &c. ...	2,069,412	366,365	Potatoes ...	1,944,361	658,877
Poultry and game	1,179,984	22,304	Onions ...	1,002,212	804
Butter ...	18,101,171	2,697,536	Tomatoes ...	655,953	297,239
Margarine ...	2,313,182	436	Apples ...	1,696,741	1,084,902
Cheese ...	2,063,524	4,991,186	Oranges ...	2,231,968	43,432
Milk ...	1,776,511	3,596	Dates ...	277,658	9,031
Eggs ...	6,398,711	218,888	Grapes ...	615,330	99,727
Lard ...	3,589,430	281,344	Nuts, edible ...	1,125,055	87,781
„ Imitation ...	301,073	5,560	Petroleum ...	5,293,622	1,729
Tea ...	1,276,489	8,364,007	Soap ...	495,552	3,468
Coffee ...	2,379,203	755,721	Tallow ...	1,093,537	894,355
Cocoa, &c. ...	1,804,252	624,010	Rosin ...	482,209	—
Sugar, refined ...	9,966,214	437	Matches ...	466,609	—

In the immense import trade of food **Breadstuffs** are the most important item, including wheat, wheat-flour, maize, oats, and Sources of Breadstuffs. barley; and of the total under this head the United States supplies about a third, and British possessions about a ninth. Of **Wheat** fully one-quarter came from the States (usually near one-half), 16 per cent from Argentina, 12 per cent from Canada, 19 per cent from Russia, but hardly any from Australasia. In some years India is a large contributor, but the supply varies greatly owing to the uncertain rainfall. Roumania is an important source of supply of the best quality

of wheat, while Bulgaria, Cyprus, Uruguay, Denmark, and European Turkey are other contributors. We get 83 per cent of our **Wheat-flour** from the States, and of the remainder about 6 per cent from Austria-Hungary, a little less from Canada, and about 3 per cent from France. Australasia, Argentina, and Belgium also send a little. The exceptionally high grade of flour imported from Hungary gives that country a higher percentage if value is regarded instead of quantity. Of **Indian Corn** or **Maize** the States send us 70 per cent of the total imported; Argentina (12 per cent), Canada, Roumania, and Russia respectively come next in order; and other sources are European Turkey, Morocco, and Uruguay. **Maize-meal** comes almost entirely from the United States. Of **Oats** Russia and the States are the most important sources of supply, Russia supplying more than one-half of the total and the States about 28 per cent. After these come Germany with 9 per cent, Canada with nearly 8 per cent, and then the Netherlands, Sweden, and Asiatic Turkey. Of **Oatmeal** and **Groats** together the total supply imported is furnished by practically North America alone, the States contributing 88 per cent and Canada about 11 per cent. **Barley** is imported from the States, Russia, Asiatic Turkey, and Roumania, the States contributing 26 per cent, Russia 25 per cent, and Asiatic Turkey 24 per cent. We also obtain barley from numerous other outside sources, including Canada, Germany, Chili, and France. **Rye** we obtain from Russia (35 per cent), the States (32 per cent), Canada, Germany, and Roumania.

Our population consumes per head over six bushels of wheat per annum, necessitating a total supply for home consumption of 240 million bushels. We grow 25 per cent of this quantity at home and import the remainder. The following table, ^{Home Supplies.} showing the acreage of land devoted at home to the important food crops we have been dealing with (and a few others), is extracted from the official Agricultural Returns:—

	England. Acres.	Wales. Acres.	Scotland. Acres.	Ireland. Acres.
Wheat ...	1,497,254	43,197	41,136	37,596
Barley ...	1,545,354	99,080	214,050	158,791
Oats... ..	1,953,866	213,266	973,110	1,097,538
Rye	52,460	1,380	5,224	10,050
Beans	226,750	1,292	11,613	2,080
Peas... ..	179,458	1,059	994	290
Potatoes ...	402,725	30,197	131,364	620,393
Small fruit ...	68,968	1,230	5,954	4,591

The **British loaf** is a wonderfully cosmopolitan article. Taking the flour supplies in the gross, the average quartern loaf of Great Britain contains 40 per cent of wheat grown in the U.S.A., 20 per cent of British, 14 per cent of Russian, 8 per cent of Argentina, 6 per cent of Indian, 5 per cent of Canadian, 3 per cent of Roumania-Bulgarian, 2 per cent of Australian, and 2 per cent from other countries.

In **ENGLAND** the county having the largest **Wheat** acreage is Lincolnshire, which has 159,000 acres devoted to this food. Next comes Yorkshire with 124,000, then Norfolk with 106,000, and Essex, 101,000. After these come Suffolk and Cambridge, also in the great eastern agricultural belt. Of the remaining counties of England seven grow from 40,000 to 50,000 acres of wheat, namely, Hampshire, Sussex, Wiltshire, Devon, Hertford, Kent, and Northampton. In **SCOTLAND** wheat is a comparatively small crop, the only counties having more than a thousand acres under wheat being Fife (9043 acres), Forfar (6375), Haddington (4652), Edinburgh (4405), Perth (4219), Lanark (2005), Berwick (1871), Renfrew, Stirling, and Linlithgow. The chief wheat-growing counties in **WALES** are Montgomery (8408 acres), Carmarthen, Denbigh, Cardigan, Glamorgan, and Flint. The average yield of wheat per acre for the United Kingdom is a little over 30 bushels.

The average yield of **wheat** for the world at large is much lower than that quoted above for the United Kingdom, being only 12.7 bushels to the acre. The United Kingdom, Belgium, and New Zealand head the wheat producers in this respect, but the vast areas of wheat lands in the United States and Russia have caused these countries hitherto to dominate the world as exporters. Whether they will continue to do so is another question. An important address on the subject of the world's wheat-supply was delivered by Sir William Crookes as President of the British Association in 1898, and in the course of it he said: "For the last thirty years the **UNITED STATES** have been the dominant factor in the foreign supply of wheat, exporting no less than 145,000,000 bushels. This shows how the bread-eating world has depended, and still depends, on the United States for the means of subsistence. The entire world's contributions to the food-bearing area have averaged but

The World's
Wheat.

4,000,000 acres yearly since 1869. It is scarcely possible that such an average, under existing conditions, can be doubled for the coming twenty-five years. Practically there remains no uncultivated prairie land in the United States suitable for wheat-growing. The virgin land has been rapidly absorbed, until at present there is no land left for wheat without reducing the area for maize, hay, and other necessary crops. It is almost certain that within a generation the ever-increasing population of the United States will consume all the wheat grown within its borders, and will be driven to import, and, like ourselves, will scramble for a lion's share of the wheat crop of the world. The withdrawal of 145 million bushels will cause a serious gap in the food-supply of wheat-importing countries, and unless this deficit can be met by increased supplies from other countries there will be a dearth for the rest of the world after the British Isles are sufficiently supplied. Next to the United States RUSSIA is the greatest wheat exporter, supplying nearly 95 million bushels. Although Russia at present exports so lavishly, this excess is merely provisional and precarious. The Russian peasant population increases more rapidly than any other in Europe. The yield per acre over European Russia is meagre—not more than 8.6 bushels to the acre—while some authorities consider it as low as 4.6 bushels. The cultivable lands of WESTERN SIBERIA adapted to grain-bearing neither equal in extent nor in potential productive powers those of Iowa, Minnesota, and Nebraska. Prince Hilkoﬀ, Russian Minister of Ways and Communications, declared in 1896 that 'Siberia never had produced, and never would produce wheat and rye enough to feed the Siberian population'. And a year later, Prince Kropotkin backed the statement as substantially correct. Those who attended the meeting of the British Association in CANADA must have been struck with the extent and marvellous capacity of the fertile plains of Manitoba and the North-West Provinces. Here were to be seen 1,290,000 acres of fine wheat-growing land yielding 18,261,950 bushels, one-fifth of which comes to hungry England. Thus far performance has lagged behind promise, the wheat-bearing area of all Canada having increased less than 500,000 acres since 1884, while the exports have not increased in greater proportion. As the wheat area of Manitoba and the North-West has increased the wheat area of Ontario and

the Eastern provinces has decreased, the added acres being little more than sufficient to meet the growing requirements of population. We have seen calculations showing that Canada contains 500,000,000 acres of profitable wheat land. The impossibility of such an estimate ever being fulfilled will be apparent when it is remembered that the whole area employed in both temperate zones for growing all the staple food crops is not more than 580,000,000 acres, and that in no country has more than 9 per cent of the area been devoted to wheat culture. The fertility of the North-West Provinces of the Dominion is due to an exceptional and curious circumstance. In winter the ground freezes to a considerable depth. Wheat is sown in the spring, generally April, when the frozen ground has been thawed to a depth of 3 inches. Under the hot sun of the short summer the grain sprouts with surprising rapidity, partly because the roots are supplied with water from the thawing depths. AUSTRALASIA as a potential contributor to the world's supply of wheat affords another fertile field for speculation. Climatic conditions limit the Australian wheat area to a small portion of the southern littoral belt. Professor Shelton considers there are still 50 million acres in Queensland suitable for wheat, but hitherto it has never had more than 150,000 acres under cultivation. Crops in former days were liable to rust, but since the rust-in-wheat conferences and the dissemination of instruction to farmers rust no longer has any terrors. I am informed by the Queensland Department of Agriculture that of late years they practically have bred wheat vigorous enough to resist this plague. . . . Notwithstanding the great yield of wheat, due to an equable climate, New Zealand finds fruit and dairy farming still more profitable. Thus the New Zealander ships his butter more than half-way round the world, and competes successfully with Western Europe. During the last twenty-seven years the AUSTRO-HUNGARIAN population has increased 21.8 per cent, as against an increase of 54.6 per cent in the acreage of wheat. Notwithstanding this disparity in the rates of increase, exports have practically ceased by reason of an advance of nearly 80 per cent in unit consumption. ROUMANIA in 1896 produced 69,000,000 bushels, and exported 34,000,000 bushels, but for many years the wheat area is not likely to exceed home requirements. FRANCE comes next to the United States as a producer

of wheat, but is dependent on supplies from abroad for an average quantity of 14 per cent of her own production. GERMANY is a gigantic importer of wheat, her imports rising 700 per cent in the last twenty-five years, and now averaging 35,000,000 bushels. The prospective supply of wheat from ARGENTINA and URUGUAY has been greatly overrated. The agricultural area includes less than 100,000,000 acres of good, bad, and indifferent land, much of which is best adapted for pastoral purposes. There is no prospect of Argentina ever being able to devote more than 30,000,000 acres to wheat; the present wheat area is about 6,000,000 acres, an area that may be doubled in the next twelve years. But the whole arable region is subject to great climatic vicissitudes, and to frosts that ravage the fields south of the 37th parallel. It will take years to bring the surplus lands of Argentina into cultivation, and the population is even now insufficient to supply labour at seed-time and harvest. During the next twelve years Uruguay may add a million acres to the world's wheat fields; but social, political, and economic conditions seriously interfere with agricultural development. At the present time SOUTH AFRICA is an importer of wheat, and the regions suitable to cereals do not exceed a few million acres. Great expectations have been formed as to the fertility of Mashonaland, the Shiré Highlands, and the Kikuyu plateau, and as to the adaptation of these regions to the growth of wheat. But wheat culture fails where the banana ripens, and the banana flourishes throughout CENTRAL AFRICA, except in limited areas of great elevation. In many parts of Africa insect pests render it impossible to store grain, and without grain-stores there can be little hope of large exports. NORTH AFRICA, formerly the granary of Rome, now exports less than 5,000,000 bushels of wheat annually, and these exports are on the decline, owing to increased home demands. With scientific irrigation EGYPT could supply three times her present amount of wheat, although no increase is likely unless the cotton fields of the Delta are diverted to grain growing. In ALGERIA and TUNIS nearly all reclaimed lands are devoted to the production of wine, for which a brisk demand exists. Were this land devoted to the growth of wheat an additional five million bushels might be obtained. The enormous acreage devoted to wheat in INDIA has been de-

The Wheat
of Africa.

clining for some years, and in 1895 over 20,000,000 acres yielded 185,000,000 bushels. Seven-eighths of this harvest is required for native consumption and only one-eighth on an average is available for export. The annual increase of population is more than 3,000,000, demanding an addition to the food-bearing lands of not less than 1,800,000 acres annually. In recent years the increase has been less than one-fourth of this. In 1904, however, India sent us 25,493,000 cwts. of wheat.

The President of the British Association drew the conclusion that as the actual and potential sources of wheat-supply are limited, whilst population continues to grow, and there is, moreover, Problem of 1931. a great growth of the habit of bread-eating, a "catastrophe" is impending. Granting that the area devoted to wheat can be extended, he nevertheless calculated that by 1931 the demand for wheat would be such that the arable areas of the temperate zone in which wheat can be grown will have to be completely used for that purpose to yield the necessary supply. And then, he asked, "Where can be grown the additional 330,000,000 bushels of wheat required ten years later by a hungry world? If bread fails—not only us, but all the bread-eaters of the world—what are we to do? We are born wheat-eaters. Other races, vastly superior to us in numbers, but differing widely in material and intellectual progress, are eaters of Indian corn, rice, millet, and other grains; but none of these grains have the food value, the concentrated health-sustaining power of wheat, and it is on this account that the accumulated experience of civilized mankind has set wheat apart as the fit and proper food for the development of muscle and brains." To avert the catastrophe of a constantly deficient supply of wheat the chemist, he argued, must come to the rescue of mankind by inventing and applying the fertilizers necessary to increase the yield per acre.

As regards the home supply of the next most important food-stuff, **Oats** are grown in ENGLAND to the largest extent in Yorkshire (251,000 acres), Lincolnshire (134,000 acres), and Scottish Oats. Devonshire (131,000 acres). Next in order as oats producers come Hants, Norfolk, Cumberland, Cornwall, Essex, Lancashire, Cheshire, and Sussex, all of which have over sixty thousand acres under oats, whilst in many other counties they are a large crop. In SCOTLAND oats are by far the largest of all the crops;

the following shows the acreage at present devoted to them in the different counties:—

Aberdeen ...	189,853	Elgin ...	22,150	Orkney ...	33,574
Argyll ...	17,491	Fife ...	39,814	Peebles ...	7,660
Ayr ...	45,407	Forfar ...	50,182	Perth ...	67,456
Banff ...	49,050	Haddington ...	17,432	Renfrew ...	11,124
Berwick ...	33,134	Inverness ...	30,702	Ross and Cromarty	31,234
Bute ...	4,833	Kincardine ...	28,376	Roxburgh ...	27,973
Caithness ...	33,374	Kinross ...	6,425	Selkirk ...	4,904
Clackmannan ...	3,379	Kirkcudbright...	26,244	Shetland ...	7,908
Dumbarton ...	7,123	Lanark...	37,131	Stirling ...	18,322
Dumfries ...	41,557	Linlithgow ...	9,861	Sutherland ...	8,119
Edinburgh ...	23,061	Nairn ...	5,756	Wigtown ...	32,501

Amongst other cereal foods **Rice** is quite the most important, forming as it does the staple food of the people in China, Japan, Burmah, and Siam, and only being distanced in that respect by millet amongst the swarming millions of India. Rice.

In short, rice is reckoned to be the staple food of one-half of the human race, and although it is not so greatly favoured in our own trying climate, it is nevertheless largely consumed, and is also an important article of trade apart from consumption. In most years rice in its various forms, including **rice-meal** and **rice-flour**, is imported into the United Kingdom to the extent of over 300,000 tons. The bulk of this rice comes from the British East Indies, from which source we receive about 80 per cent in value of the total quantity imported. The greater part of the East Indian shipments comes from Burmah and Bengal. Rice is also purchased extensively from the Netherlands, that country being a large importer from the East Indies. The quantity of rice procured from the Netherlands is roughly a tenth of the whole of our import. French Indo-China is also one of the important sources of supply. Among other countries from which considerable shipments are received should be mentioned Germany and Asiatic Turkey. A smaller but still appreciable amount of rice is recorded as coming from the United States. Of **Sago**, 99 per cent comes from the Straits Settlements, from which we get about 50 million lbs. a year. The Philippines, the Netherlands, Bombay, and Java between them supply the remaining 1 per cent.

Tea.—We now come to that important item in the grocer's

stock. The quantity of tea imported into the United Kingdom now exceeds 300,000,000 lbs. per annum, with a total value of about £10,000,000. The statistics for 1905 are:—

		Imports, lbs.	Home Consumption, lbs.	Exported, lbs.
Indian	... ..	165,750,000	150,530,000	11,795,000
Ceylon	... ..	112,556,000	89,386,000	16,151,000
Java, &c.	... ..	16,115,000	12,513,000	1,840,000
China	... ..	15,181,000	6,659,000	11,253,000
Total	... ..	309,602,000	259,088,000	41,039,000

A Board of Trade return on the subject of the *consumption of tea* shows that in Canada and Australasia, as in the mother-country of the British Empire, the consumption of tea per head is very much in excess of that of the Continental countries or the United States. Of about 600 million lbs. now annually exported from China, India, Ceylon, Japan, and Java, half (including seven-eighths of the Indian export and three-quarters of that of Ceylon) is imported by this country, and only a comparatively small proportion of this quantity is re-exported. The chief tea-producing countries of the world are China, exporting some 200 million lbs. per annum; British India, producing 190 millions lbs. a year; Ceylon, yielding about 150 million lbs.; Japan, and Java. It will be seen that of these countries China is still the largest exporter of tea, though the quantity exported is by no means so large as it used to be; thus, in the period 1884-88 the amount of tea exported from China averaged 285 million lbs., whilst in four recent consecutive years it averaged 196 million lbs., a decrease of 31 per cent. Meanwhile the exports of tea from the other producing countries have been constantly increasing of late years; in the case of British India the exports have trebled in twenty years, and in the case of Ceylon the export has risen to 150 million lbs., while in 1884 it was but 2 million lbs.

As regards sources of supply, it appears that the tea consumed in the United Kingdom is derived principally from British India and Ceylon, the quantity obtained from China having diminished of late years, not only relatively but absolutely, being now less than half what it formerly was. Of the 6 lbs. of tea which is the present yearly *per capita* consumption, 58 per cent is Indian, 34½ per cent Ceylon, 5 per cent Java, and 2½ per cent China. The consumption of tea from Ceylon is at present (1905) increasing at a more

rapid rate than that from India. The tea noted in Board of Trade returns as from Holland is really derived from Java, the chief Dutch East Indian island. In Russia the tea consumed is still principally Chinese, imported for the most part over the Asiatic frontier. In Holland about half the tea consumed comes from Java, and most of the remainder is from the United Kingdom, and is principally of Chinese origin. In the United States rather more than half the tea consumed is imported from China, but a large proportion (about two-fifths) is Japanese. In Australia about two-thirds of the tea imported is derived from India and Ceylon, and the bulk of the remainder from China or Hong-Kong. In New Zealand the quantity imported directly from China is insignificant, although a portion of that imported from Australia may be of Chinese origin. Of the consumption in Canada, more than a third is Japanese and less than a sixth Chinese. The bulk of the remainder is derived from India or Ceylon, either directly or through the United Kingdom.

Besides the sources of tea tabulated above several others are entered in the *Annual Statement of Trade*. These are of minor importance and do not require detailed treatment. They are as follows: — Germany, Japan, Russia, Macao, Canada, France, Belgium, the Straits Settlements, Burmah, and Australia. Our re-exports of China tea go mostly to Morocco, Holland, and Russia; of Indian and Ceylon tea, to Russia, United States, and Canada. It will be understood that in the official returns account is only taken of the country exporting to us, which is not necessarily the country of origin. The two largest developments of tea-production outside of India, China, and Japan have been on the islands of Ceylon and Java, where the existence in the tropics of high mountains, heavy rainfalls, and climates forcing continuous growth has made tea-growing commercially successful, although on lines materially different from those followed in China and India. Minor cultivations of tea have been attempted in Natal, Mauritius, the Straits Settlements, the Caucasus, Fiji, Johore, Brazil, South Carolina, and many other places. Tea can be grown in a tropical or a sub-tropical climate, but a rainfall of not less than 60 inches a year is absolutely necessary for its culture. In England the average yearly rainfall is 20 to 30 inches; in the tea-growing district of Silchar the

Tea
Culture.

average yearly fall is 110 inches; in Sylhet, 140; Dhubri, 97; Dibrugarh, 118. Nine-tenths of the Indian tea is grown in the two provinces of Assam and Bengal; the other tenth in Dehra Dun, the United Provinces, the Kangra Valley in the Punjab, and the Travancore district in Southern India. Of the total acreage—over half a million—under tea culture in India, some 65 per cent is in Assam, in the valleys of the Brahmapootra and Surma rivers, the latter including Cachar and Sylhet. The Dooars and Darjeeling are the great tea districts of Bengal. The area under tea in Natal is at present only between four and five thousand acres, and the annual output barely reaches two million lbs., but the industry bids fair to attain much greater dimensions.

As regards **Coffee**, the three countries where the consumption of coffee per head is the largest are Holland (with an annual average consumption of over 18 lbs. per head), Belgium, and the United States. In Belgium the annual consumption per head may be put at about 9½ lbs., and in the United States somewhat higher, averaging 11 lbs. After these countries come Germany, France, and Austria-Hungary in the order named. These are all the countries whose total consumption exceeds 50 million lbs. The United Kingdom falls far below this level with a consumption of only about ¾ lb. per head of population. As regards total consumption the United States stands pre-eminent. A recent estimate gives the following as the annual output of the chief coffee-growing countries:—

	Tons.		Tons.
Brazil	540,000	Mexico	14,000
Venezuela, &c. ...	70,000	Costa Rica	11,000
Java and Sumatra ...	59,000	Nicaragua	9,000
St. Domingo and Hayti	35,000	Jamaica	4,000
East Indies	35,000	Arabia	1,000
Colombia and Ecuador	23,000	Ceylon	950
San Salvador	15,000	German African Colonies	707

Our annual import of raw coffee amounts to 50,000 tons, more or less, valued at about £3,000,000. Much of it does not come directly from the coffee-growing countries, but finds its way to the British market through intermediate channels. The most important of these intermediary countries are France and the United States, which together furnish almost one-quarter of our

whole supply. The largest direct importations come from Brazil, the greatest coffee-growing country in the world. Brazil sends more than a quarter of our whole annual import. Other sources of supply include Costa Rica, the British East Indies, Colombia, Guatemala, Salvador, Nicaragua, Germany, Holland, the British West India Islands, Ecuador, Peru, and Natal. More than half of our imported coffee is re-exported, especially to Germany, Holland, and other countries of the European continent, and to the United States.

The Board of Trade's special return regarding coffee states that the question of the ultimate origin of the available supply of coffee for consumption in the United States and Europe cannot be solved directly, as in the case of ^{The Coffee Crop.} tea, by an appeal to the statistics of production or export of the principal producing countries, owing to the fact that as regards the Central American and South American countries, from which the supply of coffee is chiefly derived, statistics of this kind are almost wholly wanting. Estimates, however, have been made by the Board of Trade of the sources of supply of the eight principal importing countries—the United States, Germany, France, Holland, the United Kingdom, Austria-Hungary, Belgium, and Italy—as shown by their respective importation statistics; and the figures are as follows:—

Countries from which Imported by the Eight Nations:—	Quantity of Coffee Imported.	
	In 1900.	In 1903.
Brazil	Lbs. 1,179,000,000	Lbs. 1,618,000,000
Colombia and Venezuela ...	145,000,000	211,000,000
Ecuador, Peru, and Chile ...	7,000,000	3,000,000
Central America	124,000,000	158,000,000
Mexico	43,000,000	35,000,000
Cuba and Porto Rico	6,000,000	15,000,000
Hayti and San Domingo ...	98,000,000	72,000,000
British West Indies	8,000,000	11,000,000
British East Indies	53,000,000	62,000,000
Dutch East Indies	150,000,000	136,000,000
Total	Lbs. 1,813,000,000	Lbs. 2,321,000,000

Our own sources of supply included: Brazil, 32,917,000 lbs.; British East Indies, 22,520,000 lbs.; Central America, including

Costa Rica, Nicaragua, Salvador, Honduras, and Guatemala, 18,248,000 lbs.; Colombia and Venezuela, 13,347,000 lbs.; British West Indies, 1,678,000 lbs.; United States, 13,125,000 lbs.; European countries, 23,979,000 lbs.; Ecuador, Peru, and Chile, 662,000 lbs.; Mexico, 155,000 lbs.; other countries, 1,378,000 lbs. But as already stated, more than half the quantity we imported was re-exported. India and Jamaica are two of the principal sources of coffee within the British Empire, but the exports from these British possessions are but a small fraction of the world's available supply. The area under coffee in India, chiefly in the south, is less than half that under tea. Jamaica has 20,000 to 30,000 acres under coffee.

All available statistics show the enormous preponderance of Brazil as the source of coffee supply in the world's markets. In the United States, which is by far the largest consumer of coffee, more than three-fourths of the coffee consumed is undoubtedly of Brazilian origin. France, where coffee is a very popular beverage, draws a large part of her coffee from Hayti and San Domingo; whilst Holland, also a great devotee of coffee, obtains more than a half of her supplies from Brazil, and nearly the whole of the remainder from the Dutch East Indies. These facts indicate that attention to those sources of supply may be desirable to increase the sale of coffee. It is odd, certainly, that in the countries where people are fondest of coffee the article is in large measure derived from countries, such as Java, Sumatra, Hayti, and San Domingo, from which we obtain only an infinitesimal part of our supply. It is said the best coffee served in Vienna and Madrid comes from Porto Rico. Governor-General Hunt, a United States official, writes: "As an after-dinner coffee, the Porto Rican is unsurpassed, and it cannot fail to be very popular before long". For a variety of desirable qualities in the coffee-bean the British dealer usually looks not so much to Brazil as to the milder growths shipped from Central America. These are usually higher in price than Brazilian, but it is doubtful whether price is the best guide in regard to coffee. The cost of production in various countries is constantly changing, and, as a leading firm observes, "What the real cost is, and what will check increase of production of coffee, nobody has so far been able to determine in a satisfactory

Various
Coffees.

way, and production is still increasing, not decreasing". Enormous crops have been recently gathered in Brazil, and the United States, the great importer of Brazilian coffee, in some years takes over 1000 million lbs.

In India there are now about 220,000 acres of land under coffee, all but a small fraction in Southern India. The production of coffee is restricted for the most part to a limited area in the elevated region above the south-western coast, the coffee lands of Mysore, Coorg, and the Madras districts of Malabar and the Neilgherries comprising 87 per cent of the whole area under the plant in India. More than half of the whole coffee-producing area is in Mysore, where there are about 127,000 acres under this crop, and there are over 80,000 acres in Coorg, the Neilgherries, and Malabar. Some coffee is grown in other districts of Madras, but not to any extent except in Salem and Madura. It is grown also, but on a very restricted scale, in Burmah, Assam, and Bombay. The greater part of the so-called "native" coffee (Malabar, Mysore, and Salem) is shipped to Havre, while the bulk of the "plantation" coffee (Neilgherry, Coorg, and Mysore) is consigned to London. Of native Indian coffee, it is the Malabar coffee which is of the greatest importance in the Havre market, this coffee being very much appreciated in Paris. Of the plantation coffee Neilgherry has the largest sale, though the Salem is also much appreciated.

In regard to British Colonial coffee, it may be mentioned that the plant is cultivated not only in the West Indies, but also in Africa and Australia. The export from Jamaica in some years is about 10 million lbs. A newspaper correspondent, describing the Jamaica fields, says there is much difference between the qualities of the coffee grown, that from the lowlands being but slightly superior to the product of the other West India Islands, whilst the mountain coffee, owing to its rich, full flavour, enjoys an eminence with which but few East Indian coffees can compete. An average quotation for Santos (Southern Brazil) coffee is 40s. per cwt.; lowland coffee from the West Indies (including Jamaica) may command anything between 47s. and 60s.; but on the rare occasions when Blue Mountain coffee, through its comparative scarcity, enters the daily commercial record, it will be seen quoted between 100s. and 120s. per cwt.,

Indian
Supplies.

Colonial
Coffee.

and a parcel from Captain Eve's estate at Arntully fetched, at public auction in 1902, the record price of 133s. As much as £114 per ton was fetched on the London market a few years since by coffee grown in the African colony of Nyassaland (British Central Africa). The coffee industry there traces its origin to Mr. Buchanan, a Scotch gardener attached to the Blantyre Mission, who brought out from Scotland a coffee plant, and it is almost exclusively from this single plant that all the millions of coffee-trees planted in the country have come. From Natal, in South Africa, we have imported in some years considerably over a million lbs. of coffee, and a similar quantity is received from Aden. It is from Aden or Hodeidah that the so-called "Mocha" coffee is shipped; but this is a misnomer, "Mocha" coffee being raised not in Mocha, but in the interior of Arabia, Egypt, and Abyssinia, the highest grade, known as Yemen, being grown in the neighbourhood of the Oudien Valley, while the best Egyptian comes, it is stated, from Berber.

Cocoa in its crude form we import to the amount of over 50 million lbs. per annum, of which fully two-fifths comes from British possessions. The foreign sources include—Portugal (28 per cent), France (9 per cent), Brazil (7 per cent), Ecuador (7 per cent), Germany, Colombia, United States, the Netherlands, Dutch Guiana, Venezuela, &c. The largest individual source of supply, however, is the British West Indies, from which we receive about one-third of the total. From the British East Indies—chiefly Ceylon—we get about one-tenth, and other contributories in the empire are the Niger Protectorate (Southern Nigeria), the Gold Coast, Lagos, British Guiana, and Sierra Leone. London's bonded stocks of cocoa in a recent year included 19,850 bags of Trinidad, 11,750 Grenada, 12,800 Ceylon, 29,150 Guayaquil, 5500 Bahia, 3800 African, and 9400 of other sorts; total, 92,250 bags. Trinidad, whose cocoa has a high reputation in the world's markets, now exports cocoa to the value of over a million a year, the chief importer being Great Britain, the second France, and the third the United States. Guayaquil cocoa averages about 400,000 bags per annum, a great proportion consisting of the Ariba growth, the fine qualities of which are largely used by our manufacturers, and the consumption now is calculated to be about ten times as big as it was in the "fifties". A growing trade is also observable

in African cocoa raised in the Portuguese island of St. Thomas, where the crop increases every year, till it now amounts to 250,000 bags. The greater part of this cocoa is sent to the Portuguese capital, Lisbon, bulked, and shipped chiefly to the port of Liverpool, where it nearly always finds a ready market. The consul at Bahia says the cocoa there, the production of which is increasing every season, is practically monopolized by local British and German firms, "but the buying orders appear to all emanate from Hamburg". Madagascar is expected to become a large source of supply, and the district around Tamatave is said to be the best. On the African mainland cocoa has been largely planted in French Guinea, the Gold Coast, the Ivory Coast, Calabar, the Belgian Congo, and the French Congo. The world's cocoa crop in 1904 was estimated at 146,552 tons, the countries producing over 5000 tons each being Ecuador, 28,433; Brazil, 23,160; St. Thomas, 20,526; Trinidad, 18,574; San Domingo, 13,557; Venezuela, 13,048; Grenada, 6126; Gold Coast, 5687.

Prepared Cocoa and Chocolate come, to the extent of over 50 per cent of the total import, from France. Another 42 per cent comes from Holland, 6 per cent from Belgium, and a little from Germany and elsewhere.

Sugar is imported into the United Kingdom to the amount of 1½ million tons per annum, and in 1905 this was about equally divided between refined and unrefined. Next to corn and butter it is the most important article of food we import, ^{Sugar Supplies.} its value in 1904 being nineteen millions sterling against butter's twenty-one millions. The consumption per head is now nearly 90 lbs. in this country every year. According to a paper presented to Parliament, the countries at present engaged in the production of sugar "in any considerable quantity" included nearly all those pretending to civilization.

At the present time the world's annual sugar supply is about 11 million tons, of which about 60 per cent is produced from beets, and the rest from sugar-cane, the beet-sugar crop in 1905 being 6,500,000 tons. The International Union for sugar statistics, a Continental combination of sugar manufacturers, has estimated the annual sugar production from beets as follows:—Germany, 1,974,785 tons; Austria, 1,083,300; France, 1,100,171;

Russia, 893,520; Belgium, 320,000; Holland, 178,100; Sweden, 115,547; Denmark, 50,760. The cane-sugar crop of 1905-06 was estimated as follows in tons:—Cuba, 1,250,000; Porto Rico, 160,000; Trinidad, 40,000; Barbados, 50,000; Jamaica, 20,000; Antigua and St. Kitts, 19,000; Martinique, 25,000; Guadeloupe, 35,000; Demerara, 120,000; Réunion, 30,000; Mauritius, 180,000; Java, 975,000; British India, 15,000; Brazil, 200,000; Manila, Cebu, and Ilo-Ilo, 120,000; United States, 310,000; Peru, 100,000; Egypt, 50,000; Sandwich Islands, 360,000; Argentine, 130,000; Australia, 200,000—total, 4,389,000 tons. In some years Cuba produces not less than a million tons of sugar, and some authorities believe that she will yet become the largest sugar producer in the world. In the United States the production of beet-sugar is rapidly increasing, and it is confidently believed that the States will before long produce enough to supply all its own wants of this commodity. Statistics indicate that the United States consumes approximately one-quarter of the whole world's product of sugar.

Our own imported supplies amounted in 1905 to 738,000 tons of refined and 733,000 tons of raw sugar. Of the refined, Refined and Raw Sugar. seven-ninths came from Germany; then came Holland, France, Austria-Hungary, Belgium, and Russia. Of the unrefined sugar, four-sevenths were beet and three-sevenths cane. Germany and Austria-Hungary send most of the raw beet-sugar. Of the raw cane-sugar, about one-third comes from the British tropical possessions, among which the British West Indies, British Guiana, the British East Indies, and Mauritius are the principal contributors. The amounts annually received from each of these sources may be stated as follows in round numbers:—From the British West Indies, 25,000 tons; from British Guiana, 15,000 tons; from the British East Indies, 15,000 tons; and from Mauritius and its dependencies, 15,000 tons. The following are, in order of importance, the principal foreign sources of our cane-sugar:—Java, Cuba, the Argentine Republic, Peru, Mexico, the United States, Egypt, Brazil, France, the Philippine and Ladrone Islands, Chili, and Holland. Java sends us about one-seventh of the whole import of cane-sugar, namely, 27,000 tons, and more than a ninth (22,500 tons) comes from the island of Cuba. The Argentine Republic is not far behind Cuba, but its supply is rather variable. Peru's share in the total import is about one-

tenth of the total. The cane-sugar entered in the returns as from France is probably of French West Indian origin ultimately. Queensland and Natal are minor cane-sugar producers within the empire.

To supplement the enormous sugar supply required by the people of the United Kingdom we annually procure from abroad large quantities of molasses. The imports of this product, amounting to over 180 million lbs., are furnished chiefly by the United States, the value being 70 per cent of the total. The molasses from cane-sugar is held to be very superior to that from beet, which contains an excessive quantity of alkaline salts.

In India sugar is a staple crop, but a great quantity is also imported. Formerly this importation was almost entirely from Mauritius, but towards the end of the nineteenth century ^{Indian Imports.} there sprang up a large and regular trade in beet-sugar, "bounty-fed" by the fiscal laws of the European beet-growing countries. Refined sugar to the value of a million and a half has been imported in a single year by India from Austria-Hungary, besides a considerable quantity from Germany, China, Java, and the Straits. The menace to Indian and Mauritius sugar cultivation caused the Indian Government to impose countervailing duties on bounty-fed sugar at the close of 1898-99. These apparently had most effect on the beet supply from Germany, and in their effect on the supplies from other sources they may be said to have failed.

In 1903 a united effort was made by the chief nations of Europe, the United Kingdom included, to put an end to the "bounty" system by measures under the Brussels Convention, which came into effect in September of that year.

The manufacture of artificial sweetening substances which are many hundred times sweeter than sugar, and—from a chemical point of view—quite different from beet or starch sugar, is a purely new German industry. The principal substances are saccharine, a derivate of benzoic acid, and dulcine. The former is now a well-known trade article.

Honey reaches the British markets chiefly from California, Chili and Peru, the British West Indies, France, Italy, Australia, and Germany; and also occasionally from New Zealand. California comes easily first as a honey-producing country, its annual

crop being something like $4\frac{1}{2}$ million lbs. Bee-keeping is carried on chiefly along the southern coast, where the sagebrush hills supply the whitest and most delicate honey procurable. By moving the bee colonies about three crops are secured, the bees being kept active during nine months of the year. Notwithstanding the large yields of genuine honey, it is alleged against California that adulteration is sometimes practised, glucose being used as the adulterant. Chili is placed next to California as a honey producer, although the industry there is only about twenty-five years old. Good thick white Chilian honey is especially esteemed for medicinal purposes. Chilian and Peruvian honey and wax are much of the same class. The principal markets in Europe for Chilian honey are Hamburg and Liverpool, it being very rarely offered in London. Hamburg has of late years considerably developed as a port for Chilian and Peruvian wax and honey. French honey is mostly shipped to London from Dieppe, and the new crop generally comes in about August and September. About 6 million kilogrammes is an average crop, the bulk of it being consumed in France. It is seldom offered for sale in Mincing Lane. Jamaica honey has been in evidence in the London market of late years, and has become one of the cheapest varieties of honey sold. In Cuba it is said to be produced at a cost of two cents per lb. Mr. A. J. Root, an American authority, expresses the opinion that Jamaican "logwood" honey compares favourably with anything that can be produced in America. Australian honey is frequently offered in Mincing Lane, but its flavour is not greatly appreciated, probably owing to the bees having gathered nectar from eucalyptus flowers; it is also flavoured, sometimes said to be perfumed. In South Australia bee-keeping and honey production are rapidly growing, the honey produced being as much as 1,700,000 lbs. Most of this honey is consumed locally, as is also the product of New South Wales. The honey of Russia is estimated at 320,000 cwts. a year, but is not exported, being insufficient for that country's own requirements. Of the total quantity of honey imported we receive 75 per cent from foreign countries and the remainder from British possessions, the West Indies yielding over 17 per cent, and Australasia and Canada rather more than 3 per cent each. Palestine has always been famous for its honey, and is a growing

contributor to the European markets, also being an exporter of much-prized queen bees.

Glucose and Grape Sugar we import nearly all from the United States, although appreciable quantities are sent to us from Germany, Belgium, Holland, France, and other foreign countries, and sometimes from Canada also.

Amongst **Dried Fruits** currants and raisins are the leading items. **Currants** we import to the extent of about 130 million lbs. a year, nearly all of these coming from Greece, the **Dried Fruits.** monopoly home of the currant from time immemorial. A fair quantity of currants is imported by way of the Netherlands, and we obtain others *viâ* or from France, Belgium, Germany, Asiatic Turkey, and elsewhere. The larger part of our 85 million lbs. of **Raisins** comes from Asiatic Turkey; 37 per cent from Spain, $4\frac{1}{2}$ per cent from Greece, and others from France, Russia, the States, Germany, Holland, Italy, and elsewhere, the whole British Empire contributing only a trifling quantity. **Figs and Fig-Cake**, the next largest item in dried fruits, we draw mainly from Asiatic Turkey, which sends us some 17 million lbs. in a year. From Portugal we get a fair amount, and other smaller quantities from Spain, Greece, and elsewhere. **Dried or Preserved Plums**, including **Dried Apricots**, are supplied more than half by the United States, the next largest sources being France and Germany. Austria-Hungary and Australasia are also to be mentioned. **French Plums** and **Prunelloes** come almost exclusively from France, from which in some years we get fully 800,000 lbs. of them. **Prunes** now come, to the extent of about seven-eighths, from the United States. Of miscellaneous **Dried Fruits** we get large quantities from Asiatic Turkey. Our import of canned and bottled fruit is also rather extensive, and comes principally from the United States, Spain, Canada, and Australia. We also import quantities of other fruit preserved without sugar, mostly from Italy and Spain. The sources of supply of **Fruits and Vegetables preserved in sugar**, which on an average figure for some hundreds of thousands of pounds sterling in our annual importation statistics, are very varied, the largest contributor of which these returns take account being Hong-Kong (30 per cent), and the next, France (25 per cent); whilst the East Indies, the States, the West Indies, and Canada contribute considerable quantities.

Finally, a few words as to the chief sources from which we obtain our **Spices**. Of these **Pepper** is the most important, representing an annual value of about half a million sterling. Whence we get Spices. In a recent period of five years we imported on an average 20 million lbs. of pepper every year, and of this enormous quantity about four-fifths came from various parts of the British Empire. The Straits Settlements are by far the largest contributors to the stock of pepper, Singapore sending us more than half our total import. French Indo-China, Bombay, and Madras are the other sources of first-class importance, and among minor sources some of the more noteworthy are Java, Japan, Ceylon, Holland, the Niger Protectorate, Sierra Leone, Zanzibar and Pemba, Bengal, Burmah, the United States of America, Siam, Spain, and France. The terminal market makes Havre the principal market for French-Indian pepper, and there is always a considerable stock. Tellicherry and Aleppi pepper was formerly almost entirely consumed in France, but since the enactment of the French Customs law in 1897, by which pepper from French colonies enters France at a reduction of 50 per cent duty, Saigon (French colony) pepper has superseded it to a very great extent. French-Indian pepper has now found an outlet from the bonded warehouses of Havre to countries where it was previously scarcely known. A new French pepper is "Kissine pepper", which grows wild on the Liberian frontier of Guinea, in Africa. "Penang", "Nepaul", and "Jamaica" peppers disclose their origin by their name; but "Malaguetta" pepper is a name acquired in the Middle Ages by "amomi" seeds exported from Tripoli, of a botanical order which yields *Cardamoms* or "Grains of Paradise". **Ginger**, of which we import some 8 million lbs. a year, is supplied by the British Empire itself to the extent of over 80 per cent of the total supply, more than a half of this coming from Bombay and other parts of the British East Indies, whilst the British West Indies and Sierra Leone furnish each about a quarter of the import from the Empire. The United States, Japan, and Germany are other sources; and, intermittently, Canada, France, &c. **Cinnamon** we derive nearly all from Ceylon, though other supplies come *via* Germany and France, and from Madras, Bengal, Japan, Bombay, and the Straits. **Other spices** are shipped hither mainly by the West Indies, Germany, Holland,

Hong-Kong, Zanzibar, and the East Indies, the British Empire furnishing considerably more than half the total. **Cloves** come from Amboyna, Penang, Zanzibar, and Pemba; **Chillies** from Zanzibar; **Mace** and **Nutmegs** from Banda, Sumatra, Java, the West Indies, &c. **Mustard**, which in a commercial sense is one of the most important of all condiments, is imported from the East Indies and Asia Minor. Mustard is also grown in Holland, and a large quantity is grown in England itself, where the chief seat of manufacture is situated. It is obtained from the seeds of two cruciferous plants, both of which are indigenous in Britain, but neither is so well known as the common wild mustard or charlock, a familiar weed of corn-fields. The official returns of the importation of **Sauces** and **Condiments** (including table-salt) show that the principal sources of our imports of these commodities are the United States of America, Italy, Madras, Germany, France, and Bombay. **Chutney** comes almost entirely from the East Indies.

Having thus reviewed the sources whence our supplies of grocery commodities are obtained, we proceed in the following chapters to describe the commodities themselves.

2. TEA

The tea-plant is an evergreen, which in cultivation is generally found from 3 to 6 feet high. When, however, it is allowed to attain its full growth, it becomes quite a good-sized tree of 30 or 40 feet in height, and with a stem a foot or more in diameter. Contrary to general impression, it is not now thought to be a native of China; for although it has been cultivated there for over a thousand years, there is no evidence of its ever having been found wild in that country. So far as is at present known, the tea-plant is indigenous to Assam and Upper Burmah only. In China some tea-bushes still bearing are known to be over eighty years old.

The Tea-Plant.

The plant is closely allied to our well-known genus *Camellia*. Sir Joseph Hooker, in his *Flora of British India*, classifies the tea-plant as of the "Natural Order, *Ternstræmiaceæ*; genus, *Camellia*; species, *Thea*". Linnaeus originally named the plant

Thea sinensis. Afterwards, under the mistaken impression that black and green teas were prepared from the leaves of two different plants, he named them respectively *Thea bohea* and *Thea viridis*; but it is now well known that either black or green tea can be prepared at pleasure from the same leaves (the green being unfermented), so that the two last-mentioned designations are not now recognized as distinctive of black and green tea-plants. They do, however, represent distinct varieties of tea, and to these has since been added a third—namely the variety indigenous to Assam. At the present day, therefore, the following three varieties are recognized:—

Thea bohea, so named from the Bohea Mountains in China.

Thea viridis sinensis, also a Chinese variety.

Thea viridis assaminensis, the Assam variety.

All the various teas are prepared from these, and from crossings or so-called “hybrids” between them.

Little is known about the early history of the use of tea as a beverage. The Chinese have some legendary references to it, going back some four or five thousand years, and
Tea History. dealing with the exploits of a certain Chin-Nung; but this person is said to be mythical, and we have to come down to much later times before getting any reliable information. By the sixth century of the present era tea appears to have become a popular beverage in China. Early in the thirteenth century a certain missionary took some seeds of the tea-plant to Japan, where the cultivation was introduced; and these two countries, with the exception of a few districts in Cochin and Tong-king, remained the sole tea-producing centres until well into the nineteenth century.

Tea first became known to Europeans about the end of the sixteenth century, and early in the seventeenth occasional small quantities of Chinese tea began to be received in London. It became less of a rarity towards the middle of the century, and in 1657–1660 a merchant who had received a large consignment opened a house for the sale of the prepared beverage. A duty of 8*d.* per gallon was levied for some time upon this infusion, and was changed to one of 5*s.* per lb. in 1689.

The cultivation of tea in India dates from the early part of the

last century, although as far back as 1788 Sir Joseph Banks had drawn attention to the possibility of tea being successfully grown in the country. No practical steps, Indian Tea. however, were taken at the time to work out the matter. But some thirty-five years later, in 1823, a traveller named Bruce discovered the tea-plant growing wild in Assam. The question was thus brought forward again; it was further enquired into during the next few years, and in 1835 the government opened the first tea-garden of Assam. In 1839 the Assam Tea Company was formed, and after many vicissitudes the industry finally became firmly established in the land.

At the present time about half a million acres are devoted to the cultivation of tea in India. The chief tea-growing districts are the following:—

- In Assam: Assam proper, Sylhet, and Cachar.
- „ Bengal: Darjeeling and Terai; Dooars, Chittagong, and Chota Nagpur.
- „ the United (N.W.) Provinces: Dehra Dun and Kumaon.
- „ the Punjab: Kangra Valley.
- „ Madras: Neilgherry district, Wynaad, and Travancore.

The plant most commonly grown is a so-called hybrid between the indigenous Assam stock and the Chinese varieties. These “hybrids” have usually smaller leaves than the native plant, and are more hardy than the Chinese. They have been produced by fortuitous crossing, and some authorities hold that the crossing of the indigenous *Thea assaminensis* with the imported *Thea bohea* has produced very considerable mischief in the Indian tea trade; but the crossing with the other Chinese variety, *Thea viridis sinensis*, is held to be an improvement.

The Assam leaf is described as “long, thin, membranous, and often undulated; whilst the China leaf is short, thick, coriaceous, and generally straight”. The flowers in both cases are white, resembling more or less the common hedge-roses; but in cultivation flowering is only allowed to take place in the plants intended for seed-growing. All varieties of tea-leaf are characterized by having a looped or meshed system of veining, and a toothed margin carrying short spines. The leaves, in non-technical language, are simple in form, glossy, shining, somewhat tough,

and have toothed edges. The plant when wild sometimes grows to a height of 20 or 30 feet, but in cultivation it is cut down to a spreading shrub 2 or 3 feet high.

Although there are some differences in practice, the methods of tea-growing are substantially similar in all the tea countries. A sketch of the process as carried out in India and Ceylon will serve best as a general example.

The tea-plant is propagated by seed, the best quality being said to be obtained in Upper Assam and Manipur. The seed is raised in seed-gardens, set apart for the purpose on the various estates, and somewhat resembling ordinary orchards in general appearance. It begins to ripen in September, and after harvesting is separated into good and bad by being thrown into water, that which floats being rejected as worthless. The good seed, which resembles hazel nuts in appearance, is allowed to germinate in wet sand, and when sprouted is planted out in the nursery beds at distances of about 4 inches apart. When about a foot high and six to eight months old, the young tea-plants or seedlings are taken out of the nursery and transplanted in the plantation, where they are set 4 feet from one another in rows.

In making the plantation, the land after clearing is first deeply dug over with hoes, the tillage being practically everywhere carried on by hand labour. When the seedlings have been planted out, the plantation is divided up into sections of from five to ten acres each by paths or roads. These sections are drained by "*nullahs*" or ditches of 3 to 6 feet in depth, and running between the rows of tea-plants at distances of 6 to 12 yards from one another. Frequent hoeing and weeding are required—about once a month or so.

From the second year onwards the young plants have to be regularly pruned to free them from unproductive portions, in order to leave young and vigorous leaf-producing branches and shoots. Moreover, as most of the leaves are gathered from the upper parts of the shrubs, the height of the latter is kept down in pruning, so that the gathering can be done without inconvenience.

Towards the latter end of March (in India) the leaves are first plucked. The end of the shoot with the bud, and either one, two, or three leaves are picked off; the number depending upon whether fine, medium, or coarse tea is required. According to

Mr. G. W. Christison (*Tea-planting in Darjeeling*), the bud yields "golden tips" or "silver tips", *i.e.* the finest tea; the top leaf forming the next quality, "orange pekoe", or, when ^{Gathering the Leaf.} large, "pekoe"; and the second or lower leaf generally yielding "pekoe", but "pekoe-souchong" when the leaf is large. These designations, however, are used with some latitude, as will be seen later on.

Generally, the first shoots of the new growth of the season, bearing four to six leaves, go to make up what is termed the "first flush", and the gathering commences when this is ready. The youngest leaves of the "flush" having been picked as just described, the remainder of the shoot is left to form future "flushes". Subsequent gatherings take place at intervals of a few days, the season generally lasting from March to November. About 300 lbs. of finished tea are obtained from one acre of ground.

In China and Japan the "first flush" teas are accounted the best; but in India and Ceylon they are always distinctly inferior in quality to the subsequent ones.

Formerly the method of manufacture in India was practically the same as in China. Everything was done by hand. At the present time it may be said that almost everything is ^{Process of} done by machinery in India and Ceylon. The tea is ^{Manufacture.} scarcely touched by the hand from first to last after reaching the factory; and in this respect it offers a marked contrast to the China product.

The processes involved are the following:—(1) Withering or "limping"; (2) rolling or "curling"; (3) fermenting; (4) drying or "firing"; (5) sorting and cutting; and (6) final firing. About twenty-four hours are required for the complete manufacture.

(1) **Withering.**—As soon as they are weighed in from the pickers, the leaves are spread over coarse cloths placed on withering-floors (or "chungs") of bamboo-latticing, or else on trays of wire meshing, in order to become partially dry. The same object is more quickly obtained by "artificial withering", which consists in exposing the tea to a current of warm air. When it becomes dry and spongy, which in dry weather is after about six hours by the "natural" process, the tea is ready for rolling.

(2) **Rolling.**—This is effected in a rolling machine, in which the leaf is subjected to pressure in order to burst the leaf-cells and liberate their contained juices. At the same time it gives a little roll or twist to the leaf, which improves its appearance. During this operation the leaves are changed a little in colour, becoming slightly yellowish.

(3) **Fermentation.**—The rolled leaf, first passed through a machine if necessary to disintegrate any lumps, is spread in layers over a cool floor and covered with wet muslin. A few hours suffice for the completion of the process, which is usually considered to be a fermentative operation, but which is thought by some authorities to be rather ordinary chemical oxidation than a true fermentation brought about by micro-organisms. During its progress there is said to be an increase in the essential oils of the tea, and an alteration of some of the tannin. A second, lighter rolling is usually given after the fermentation is finished, in order to restore the proper "curl".

(4) **Firing.**—The object of this is to stop the fermentation and expel the excess of moisture. Machines in which the tea is dried by means of heated air are now almost universally used. This "firing" or drying may be done in one, two, or three stages; the temperature of the hot air being first about 300° F. and afterwards about 200°. The leaf becomes more or less blackened during this operation, and is then substantially in the finished state. It is now called "rough" tea.

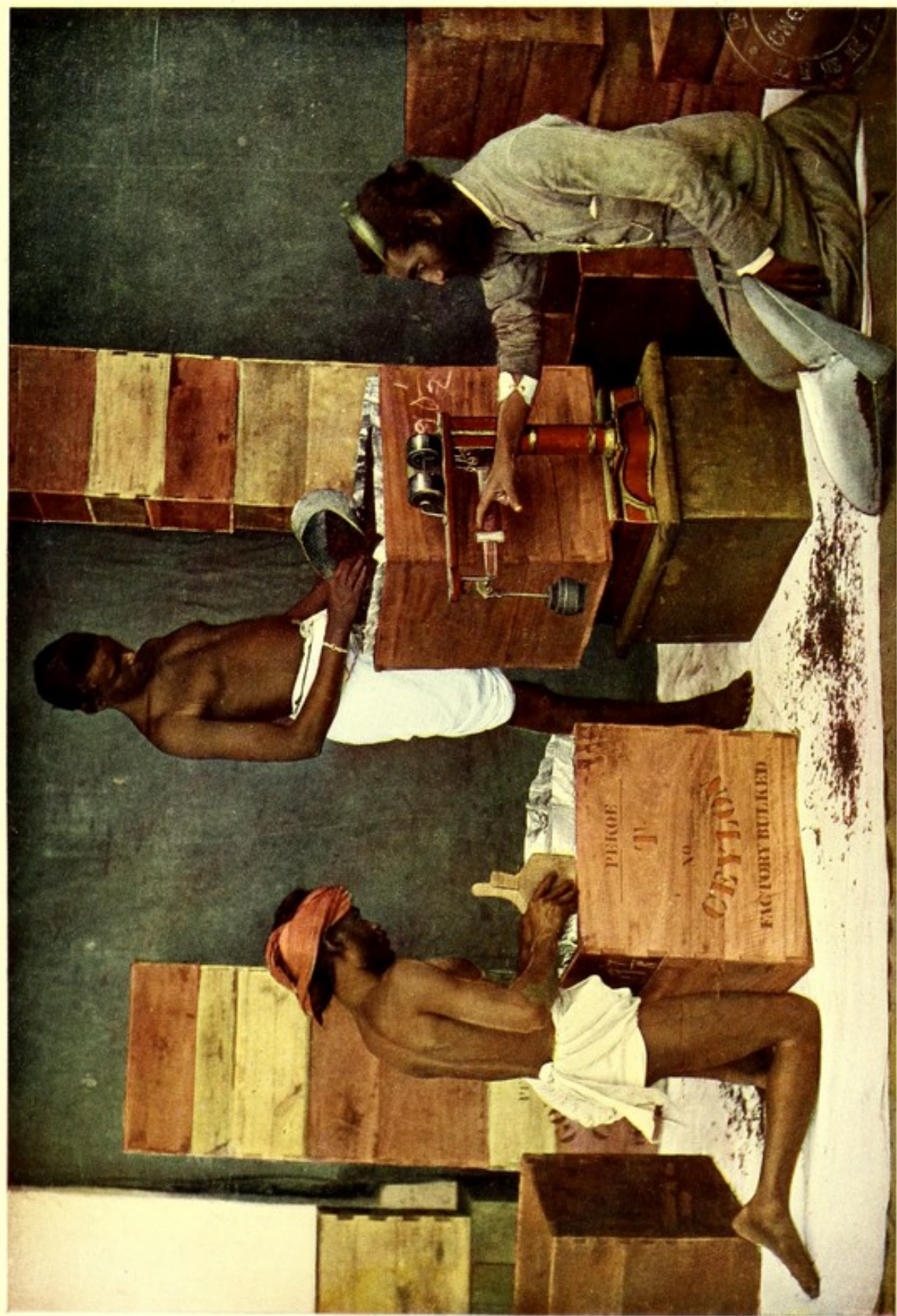
(5) **Sorting.**—The rough tea is first hand-picked to remove "red leaf" (old leaf), bits of bamboo, and other foreign debris, and then passed through a sieve to separate the smaller, choice, and fine teas. These are called "unbroken" or "whole" teas. The larger, coarser leaves are then passed through a tea-cutting or breaking machine, which breaks them into smaller portions. These "broken teas" are again sifted and classified according to size.

The classification of the teas varies a good deal, some managers arranging their products in a larger number of classes than others do. From seven to twelve kinds are usually recognized, an example being:—

Unbroken Teas.—Flowery Pekoe, Orange Pekoe, Pekoe, Pekoe Souchong.

PACKING TEA IN CEYLON

The remarkable development of the tea industry of India and Ceylon is referred to in the text. It is one of the economic features of our times that are of world-wide importance. Not insignificant is it, moreover, as exemplifying the effect of the British *raj* upon the world's peaceful progress and development. With regard to statistics of the trade, in supplement to those given in the text, it may be mentioned that of late years the quantities of tea re-exported from this country, to foreign and colonial customers, show a large preponderance in favour of the Ceylon-grown leaf. In 1903, apart from transshipments, the amount of tea thus imported by our merchants and re-exported from these shores, was: Ceylon, 15,753,804 lbs.; Indian, 10,871,076 lbs. The illustration shows the process of packing on a Ceylon tea estate.



PACKING TEA ON A CEYLON ESTATE



Broken Teas.—Broken Pekoe, Pekoe Dust, Broken Mixed, Broken Souchong, and Fannings.

But one or more of these varieties may be omitted, or may receive a different name, according to the practice of the particular factory. Thus another classification is:—

Unbroken.—Flowery Orange Pekoe, Orange Pekoe, Pekoe No. 1.

Broken.—Broken Orange Pekoe (or B. O. P.), Pekoe No. 2, Pekoe Souchong, Souchong, Broken Pekoe, Broken Pekoe Souchong, Fannings, and Dust or Sweepings.

(6) **Final Firing.**—Finally, the different teas are fired again in a “sirocco” or drying machine, in order to remove moisture taken up during sorting; and while still warm they are packed into lead-lined chests for exportation.

With regard to the general characters of Indian teas, Assam leaf is a “strong” tea—more remarkable, in fact, for strength than for fragrance. It gives a highly-coloured and pungent infusion, as a rule; so that it is a useful tea for blending with thinner kinds. When used by itself the general run of Assam tea is harsh to the palate, and a liking for it is rather an acquired taste with most people. But some of the Fine Pekoe Assam teas have very delicate flavour, and yield a light-coloured liquor. Darjeeling produces some of the finest tea imported from India. The leaf is generally small and regular, with a pleasant aroma. The infusion is lighter in colour but of finer flavour than that made from the ordinary Assam leaf; and for fragrance and delicacy the best samples are fully equal to the highest qualities of China tea. No doubt the Darjeeling product owes much of its fine flavour to the fact that it is grown at a great altitude, some of the tea-gardens being on the sides of hills which are five to six thousand feet above sea-level. The teas from the Cachar and Sylhet districts may be described as intermediate between the strong Assam crops and the well-flavoured productions of Darjeeling. Strength without harshness may be said to be the character of the infusion, and the tea is a good one for general use. Kangra Valley, Kumaon, and Dehra Dun are relatively small tea-growing districts, the two first especially furnishing teas which are largely drunk by Europeans in India. The quality of the supply, however, appears to fluctuate a good deal; and these

Character of
Indian Teas.

localities are hardly likely in the future to be able to compete with Assam and Ceylon in the London market.

Very little *green* tea is made in India. What little is manufactured is chiefly produced in the United Provinces.

The special characters of the leaf are as follows:—

(1) **In Indian and Assam Teas generally.**—*Flowery Pekoe* and *Orange Pekoe* are smaller, more curly, and more full of tips than *Pekoe*. The colour of these three ranges from gray-black to black. White or orange tips are more or less prevalent. *Broken Pekoe* often contains more tips than the above three, and the infusion is darker, with more body. *Pekoe Souchong* is coarser than *Pekoe*, and not so well made. Distinguished from *Souchong* by the tips and tighter twist. *Souchong* has a large, coarse, rough leaf of dead gray-black colour. Used only in blends. *Broken Souchong*, *Fannings*, and *Dust* give a dark liquor, thicker than that from whole leaf, but not so strong.

(2) **In Darjeeling Teas.**—*Orange Pekoe* and *Pekoe* have a small, curly, tightly-twisted leaf, brownish-black in colour, and orange-tipped. Used either by itself or for flavouring blends. *Pekoe Souchong* and *Souchong* are larger and looser than the *Pekoes*. Colour brownish-black to black; more or less orange-tipped. *Broken Pekoe* is of brownish-black colour, often full of deep orange tips. Infusion of deep rich colour, and full nutty flavour.

A very considerable quantity of tea is now grown in Ceylon. Coffee-growing, which previous to 1870 was the great Ceylon industry, had been by that date practically ruined by the ravages of a leaf fungus and of a pest known locally as the "Black Bug". The planters, casting about for something to take the place of coffee, noticed that tea-plants flourished uninjured side by side with coffee-plants which were unable to live; and about 1873 the cultivation of tea was taken up in earnest. How much success the new industry has achieved may be gathered from the fact that whereas thirty years ago there were only 10 acres of land devoted to tea-cultivation, a recent estimate places the present area at about 400,000 acres, and the amount of tea exported at something like a hundred million pounds weight per annum. The cultivation and manufacture are substantially the same as in India, and nothing further need be said on these points. As regards the product, Ceylon teas have

in the past obtained some reputation for irregularity of quality. The best kinds compete well with the Darjeeling teas. They have more strength than the latter, whilst at the same time they are soft and delicate, with good fruity flavour, and without the excessive pungency of the Assam teas. In recent years the quality has no doubt been much more uniform than it used to be, and certainly the Ceylon product has become a popular article, whatever its aberrations may have been. The Ceylon teas are used both blended and alone.

Supplies of Ceylon tea arrive at all seasons of the year, so that there is no special month for new Ceylon teas.

In Ceylon leaf, **Orange Pekoe** and **Pekoe** are rather smaller than Indian teas of the same classes, with a more dead-black colour, and the tips more orange or golden. **Broken Pekoe** gives a dark-coloured infusion, with more body The Ceylon Leaf. than the above, but less "life". **Pekoe Souchong** and **Souchong** are curly-leaved, almost dead-black in colour. Not so much tipped as Pekoe. Infusion fairly bright and clear; sharper, coarser, and more pungent in flavour than the Pekoes. Used both alone and for blending.

Ceylon teas having rather uncertain keeping qualities, a chest once opened should be used as quickly as practicable.

We next come to the teas of China. According to Robert Fortune, who many years ago penetrated into the interior of China disguised as a mandarin, there were at that time three main tea-growing districts, and no doubt China Teas. his description is substantially true at the present day. The three were:—(1) The green-tea district, about 200 miles inland, up the Hwuy-Chow (Kouy-Chow) or Green River, lying between 29° and 30° N. lat. and 117° and 119° E. long. The plantations were originally on the Sung-lo Hills, but afterwards on the plain below. (2) The great black-tea district of the Bohea Mountains, at about 28° N. lat. and 116° E. long. The finest Pekoes and Souchongs came from the northern side of the hills, but were mostly consumed in China, only a small quantity being exported. The so-called "Bohea Tea", however, was not produced on the Bohea mountains, but in the Canton district. It is—or rather was, for the tea is scarcely heard of nowadays—an inferior product obtained from *Thea bohea*, whereas the finest black teas of

the Bohea Hills, and the fine green teas of the Kouy-Chow country, are both obtained from *Thea viridis*. (3) The coast district of Shan-hing-foo (lat. 30° N.), and the Chusan Islands. Here excellent tea was grown, but only, or mainly, for home consumption. Kwang-tung, Kiang-se, Kiang-su, Fuh-kien, and Che-kiang are the provinces which export most tea.

In China there are at most four or five tea-harvests during the year. The tea prepared from the first gathering is the most delicate in colour and flavour, and is reckoned the best in quality; the succeeding crops decrease in value as the season gets later. Black tea and green tea, Pekoes and Souchongs, Hysons and Gunpowders, are but different growths of the same plant, varying in flavour and strength according to the age and tenderness of the leaves and the way in which they are rolled. The fine downy leaves at the tip of the shoot make the Pekoes (*pak-ho* = white hairs); next are the Souchong leaves (*siaou-chung* = little plant); then the Congou (*kung-fu* = labour); and last, the rougher and more expanded leaves may be used for Bohea. The first plucking in China takes place in April, the second about the beginning of May, the third in June or July, and the fourth and fifth from July to September. On account of its tenderness, the first crop requires to be very carefully handled.

Green Tea.—The following is a summary of the processes adopted in China. Those used in Japan are substantially similar, with certain differences of procedure; *e.g.* there are three rolling operations, and the first takes place before the first roasting.

To get rid of the raw flavour, and preserve the colour, the leaves are spread out in bamboo trays and fitted into a bamboo box, at the bottom of which is a boiler. Here the leaves are steamed for an hour or two, after which they are exposed on tiled floors or on bamboo trays out-of-doors in the shade, to prevent their turning yellow. Meanwhile they are separated from stalks and dirt. The leaves are next put in an iron pan, half a pound at a time, and heated in a stove over a brisk fire for about five minutes, being stirred rapidly all the time with the hand. When taken out they are still moist and flaccid, but much of the water has been expelled from them. The next process is rolling. This is done on a rattan table, where the leaves are

rolled by hand into balls, passing from hand to hand until they reach the head workman, who sees whether they have the proper twist. If so, they are shaken out into sieves or flat trays, and allowed to cool for a few minutes. The object of the rolling is to break the cells of the leaf; the contents then exude and impart a fine aroma to the tea. A second roasting is performed over a slow charcoal fire for an hour or so, by which time the green colour, dull at first, gets gradually brighter, and becomes fixed. The sifting is first done by means of sieves of different sizes; then the leaves pass through the winnowing-machine. The latter treatment gets rid of impurities, and separates the different kinds of tea according to size and twist of leaf. During the sifting process the leaves undergo a *third roasting*, and the finer kinds may be fired four or five times.

The chief varieties of green tea are the following:—**Hyson** and **Young Hyson**: Leaf buds and first leaf; picked in April. Hyson is a rather long, fairly well-twisted, silvery-green leaf, with slight curl. It gives a clear, pale, pungent liquor, with sharp, strong flavour. Not much used in England now. Young Hyson is a small, tightly-twisted, and curly tea, of lightish-green colour. The infusion is more delicate in flavour than that of Hyson. According to some authorities, “**Gunpowder**” tea is simply carefully-selected Hyson. Messrs. Johnston & Church say that Gunpowder is flavoured with the sweet-scented olive (*Olea fragrans*), and comes from a special plantation. The leaf is small, short, tightly-rolled, and of a good green colour. Liquor clear, pale straw-colour; pungent, with a sharp delicate flavour inclining to bitter. Used for mixing with black teas. **Imperial**, or “**Pearl**”, is a large leaf, often rather tightly rolled, but sometimes loose in make; of green, bluish-green, or silver-green colour. Coarser in flavour than Gunpowder. True “Imperial” is said to be rarely sent to Europe; and according to Johnston & Church what we call “Imperial” is a tea from the Chusan Archipelago, flavoured with the *Olea fragrans*. **Twankay** is a rough-flaked, low-quality green tea, giving a rather muddy liquor, with coarse common flavour.

In addition to the above there are a few further subdivisions; e.g. **Pingsuey**, a Gunpowder; and **Feong Mee** and **Sow Mee**, Hysons. The chief demand for green teas is in the United States, and it is

largely supplied by Japan. In this country green teas are chiefly used for giving flavour and "life" to blends. When green teas are "faced" to improve their colour, the ingredients used are such things as Prussian blue, French chalk, indigo, turmeric, and soapstone. To add these, the leaves are usually moistened with water and reheated. Then the finely-powdered colour is shaken over the tea, which is mixed well until a uniform tint is obtained.

The great difference in the methods of manufacturing green and black teas consists in the black being fermented before roasting, whereas the green are not. Moreover, since
Black Teas. in making green tea the object is to keep the colour and prevent fermentation, the leaves are roasted as soon as possible after picking; whereas in the manufacture of black tea the leaves are dried slowly before manipulation. The following are the processes:—**Withering:** The leaves are spread on bamboo trays or mats, and exposed out-of-doors for some hours. Or, if the season be wet, the drying takes place indoors over hot charcoal. During this process the tea loses some of its moisture; but the leaves are pliable still, and the stalks bend without breaking. **Tossing and fermentation:** The leaves are then tossed and gently patted by hand until they are soft and flaccid. After this they are heaped, covered with a cloth, and allowed to ferment, being carefully watched until they assume a slightly reddish tinge, and give out a fragrant smell. **First roasting and rolling:** When fermentation has gone far enough, the tea is roasted for five minutes in iron pans over wood fires. It is then—or, sometimes, before roasting—rolled on a rattan table in the same way as described for green tea. **Exposure out-of-doors:** After being spread thinly on sieves, the leaves are put out-of-doors on bamboo frames for about three hours, with occasional turning. When sufficiently dry, they are taken to the factory and submitted to a second roasting and rolling, similar to the first, described above. **Drying and rolling:** The further drying is done in tubular baskets called "*poey-longs*". These have cross-wires about the middle, on which rests a sieve containing the tea, spread on the sieve to a depth of an inch or so. The *poey-long* stands upright over a low charcoal stove, the hot air from which dries the tea on the sieve. The tea is alternately dried and rolled

until the leaves are dry and crisp, and have obtained the proper dark colour. Sifting is done on circular bamboo sieve-trays, large leaves being, if necessary, removed by hand. The final drying is effected over a slow fire, the leaves being placed more thickly on the sieves of the *poey-longs*. The mouths of the latter are closed with a tray, and the baskets are placed over the stoves for about two hours. The tea is then ready for packing.

The principal kinds of black China tea are Monings, Sou-chongs, Oolongs, Kaisows (red leaf), Pekoes, and Congous, with the fancy teas mentioned below. These, especially the Monings, are further subdivided into a number of classes, such as, for instance, Kintuck, Ningchow, Oopack, Oonam, Oonfa, and Shantam amongst the Monings; Lapsang Souchong; Formosa Oolong; Soomoo Kaisow; and Tayshang Congou. Monings are soft, smooth-drinking teas. In some seasons they have a slight inclination to a "malty" or "tarry" flavour. Kaisows have more "life" than Monings, and are fresher in the cup. The Monings and Kaisows are not so pun-
China Tea
Characteristics.
gent and full-flavoured as Indian teas. Oolongs are pungent, faintly "herby" or bitter. Souchongs have a delicate flavour, and are perhaps the finest of the black-leaf teas. They are used either by themselves or in blends. Scented Orange Pekoe and Scented Caper both give a pale strong tea. These are used solely for flavouring blends. The special characters of the leaf are:—
Monings: Grayish-black, curly, more or less tipped. **Kaisows:** Rather curly; reddish-black in colour. **Oolongs:** Rough, coarse in make, with a somewhat greenish appearance. **Souchong (Lapsang):** Almost dead black; large, loose in make; slight curl. **Pekoe-Congous, or Packlings:** Small, reddish-black; tightly twisted and curly. **Scented Orange Pekoe:** Dark-green; long spider leaf (*Canton*) and small curly leaf (*Foochow*). **Scented Caper:** Small, shotty; some black and glazed; others greenish-black or olive-coloured.

The year-book of the Planters' Association of Ceylon gives the following account, transcribed from an official publication by the Department of Agriculture and Commerce of the
The
Manufacture
of Formosa
Oolongs.
Government of Formosa, of the manufacture of Oolong Tea as practised in Formosa:—

"The preparation is twofold. The first, which is but temporary, is made at

the tea-maker's. The second, which is the final one, on the premises of the tea merchant.

"A.—TEMPORARY PREPARATION

"As the work is done by men's hands only and without any machinery, the result depends on cleverness, which is acquired only after years of practice.

"The picked leaves are spread on a cloth called 'moâpôtiâ' and put out to dry in the sun, in order to obtain a first softening. Then they are stored in a room, where they undergo a second softening, heaped up in 'kalei' (a sort of frame or round board made out of bamboo strips interwoven), placed one over the other. Poured back into vases called 'kamwo', they are submitted to a third and last softening before being warmed in pots. The softening, having for its object to perfume the tea by the fermentation that it produces, is a delicate and important operation, which requires from the workmen great cleverness. In order to obtain a good result from the three successive operations, it is necessary to constantly observe the state of the weather and to take note of it. The heating in pots (*à la marmite*) is made at two different times. In this operation the difficulty is to get the necessary degree of heat. When out of the pots (*marmite*) the tea is dried at three different times in vases called 'poelan' with a fire carefully regulated. The process requires altogether 7 hours 50 minutes in spring, 5 hours 54 minutes in summer, 7 hours 38 minutes in autumn, and 7 hours 13 minutes in winter.

"What is essential in the preparation of 'Oolong' tea is to give to it first its perfume, then its flavour and colour, which is seen when decocted. Its appearance when dry is a matter of less consideration. . . . The tea of 'temporary preparation' is called 'tea in bag', because the producers carry the same and deliver it in bags of the capacity of about 30 kilograms.

"B.—FINAL PREPARATION

"The tea merchants of Toa-Ko-Ham buy from the cultivators the temporarily prepared tea, which then undergoes a second and last process in the manner following:—

"The leaf is passed through a perforated framework, being then thrashed with a winnow called 'shokalei'. In this manner only the finest leaf remains. This is then put for seven or eight hours in an oven and warmed to the right temperature. This work finished, the tea is packed in cases. The second preparation reduces from 10 to 15 per cent the original quantity of tea which has been so treated, and the tea-cases are of a square shape, in wood, fitting exactly to a double case in tin. The wood used for the manufacture of the outside case reminds one of 'Cryptomeria', but it is harder and less elastic. Every year it is imported from Amoy.

"The dimensions of the cases are not uniform; some can contain 20 to 33 catties¹ (27 to 44 lbs.), others from 7½ to 15 catties (10 to 20 lbs.). The large size is called a 'half-chest' and the small a 'box'. Outside all, the cases are wrapped up with paper upon which are designed flowers, birds, or personages, and which bear also the name of the tea merchants. Tea, after its second process, is commonly called 'tea in case'. 'Oolong' tea holds the mean between black and green tea, from which it is distinguished by its delicious perfume and agreeable flavour. It has

¹ A catty is 1.33 lbs. avoirdupois.

both refreshing and stimulating properties. It bears different marks, which are generally used in the markets of Amoy and America as distinguishing the qualities: 1st, Choicest; 2nd, Choice; 3rd, Finest; 4th, Fine; 5th, Superior; 6th, Good; 7th, Fair; 8th, Common."

The scented varieties of tea, such as Scented Orange Pekoe, Scented Caper, and Glazy Ouchain, are produced by heaping the finished green or black teas with various odoriferous flowers. The chief flowers used for this purpose are the sweet-scented olive (*Olea fragrans*), and the Chulan flower (*Chloranthus inconspicuus*); with one or two varieties of jasmine and gardenia. When the tea has become sufficiently impregnated with the aroma the leaves are separated by sifting, and packed at once in air-tight chests.

Varieties of
Fancy Tea.

Caper Tea, which may be either plain or scented, is composed of the dust of various teas made into hard grains by means of gum or rice-water. Some varieties of Caper tea are black, others green (olive-coloured). The small grains sifted from Scented Caper are called Ouchain tea. The Caper trade is rapidly dying out.

The following special varieties of tea may be noted here, though not now commercial articles in this country:—

Bohea Tea is a sort of compromise between the old green teas and the modern black fermented ones. Owing to a peculiar process of roasting in copper pans it has the appearance of the black teas, whilst its general character is that of the green.

Brick Tea is manufactured in China, chiefly for consumption in Siberia. The best kind is made of black tea-dust, pressed by machinery into "bricks" of about $2\frac{1}{4}$ lbs. weight each. Russia imports annually over 34 million kilograms of Brick tea, mainly from Hankow. According to a consul's report there are two qualities, the first quality measuring 227 millimetres long by 160 wide and 11 thick, and weighing $\frac{1}{2}$ kilogram each. Bricks of the second quality measure 287 by 183 by 22 millimetres, with an average weight of 1.160 kilogram.

Lie Tea was at one time largely imported into England from China. It consisted of the sweepings of the tea-warehouses, cemented by rice-water or gum and rolled into grains.

China teas are chiefly exported from Foochow, Hankow, Canton, Macao, Shanghai, and Hong-Kong. In the interior, the great emporium of the black-tea trade is Ho-kow (Ho-how), a

large town of 300,000 to 400,000 inhabitants. In former times the East India Company used to keep a staff of tea-tasters at Canton; but Chinese tea is now generally tasted in London, and Canton is no longer the chief tea-port.

Japan exports a considerable quantity of tea—in 1903 over seventy million pounds—but Japan tea is not much seen in this country. In America it is consumed to some extent. The leaf is chiefly of the Oolong character. There are four classes:—
1. Hikicha or tencha—powdered tea—only used for the “cha-no-yu”, or tea ceremony, or on very State occasions. 2. Green tea—(a) Gyokuro—pearly dew—costing from 7 to 10 yen or even more per lb.; (b) Sencha, the second quality of green tea, ranging in price from 30 sen to 3 yen per lb.—the tea ordinarily drunk by all but the lowest classes. 3. Bancha, consisting of last year’s leaves, withered stalks, chopped branches, &c., and costing about 10 to 15 sen per lb. 4. Black tea and Oolong.

Tea that has been graded and mixed at the gardens in India or elsewhere is called “factory bulked”, and a quantity prepared for the market is called a “break”. The “bulking” consists in mixing the contents of a number of chests of the same “mark”, that is, containing the same class of tea from the same plantation.

On its arrival in the Thames the tea is landed at the various bonded warehouses, where it is assessed for payment of duty and sometimes re-bulked in order to ensure uniformity. Bonding and Tasting. The “breaks” are catalogued, and samples drawn for examination by brokers and dealers, after which the various parcels, still remaining in bond, are sold by auction at Mincing Lane. The tasting of tea-samples, according to Mr. R. Bannister, is done as follows:— $43\frac{1}{2}$ grains (the weight of a sixpence) of the tea is infused in $3\frac{1}{2}$ ounces of water poured on at 100° C. (212° F.)—*i.e.* actually boiling—when 20 per cent of the total extract is obtained, and 50 per cent of the theine. The tasters then judge by the bouquet, flavour, and pungency of the infusion, also by the colour, uniformity, and age of the leaf. (See next chapter.)

The most important chemical constituents of tea are a volatile Chemistry of Tea. essential “oil of tea”; an alkaloid termed “theine”; tannin; and albumin. In addition to these there is a considerable quantity of cellulose present, with smaller amounts of

gummy and resinous matters, and mineral substances. The physiological value of tea depends chiefly upon the amount of theine which it contains; but the *commercial* value is determined entirely by the flavour, aroma, "body", strength, and such like palate-characters. Of these, the flavour and aroma are largely due to the volatile oil and to the resinous ingredients, whilst the gummy substances, the albuminoids, and the tannin chiefly decide the character of the "body" and the amount of "strength" and fulness to the palate. Oil of tea is present in very small quantity. It is a yellowish liquid obtained from the tea by distilling it with water. It possesses the peculiar taste and smell of tea, and has powerful stimulant properties. When taken in rather large doses it is said to produce headache and giddiness. Theine is the alkaloid of tea, and is very rich in nitrogen. It is chiefly to theine that the beneficial and stimulating properties of tea are to be ascribed, although some of the effects are no doubt due to the essential oil. Theine is combined with the tannin in the tea; when separated, and crystallized from water, it forms long needle-like crystals of white colour and silky lustre. It has a feeble bitter taste. Tea contains from 2 to 4 per cent of theine. Tannin is the most abundant substance dissolved in the infusion of tea. It is an astringent body, and possesses the property of combining with gelatine to form the essential ingredient of leather. For this reason too much tannin conduces to indigestion, since various articles of food may contain more or less gelatine, which with the tannin forms a leathery indigestible compound. The albuminoids of tea are mainly left with the tea-leaves when an infusion is made, but a certain proportion is dissolved, and to this extent it influences the character of the beverage. The gummy substances are pectin and pectic acid, which are readily dissolved by water and are consequently found in the tea-infusion. The mineral matter (ash) of tea consists largely of phosphate and carbonate of potash; its amount is usually from 6 to $7\frac{1}{2}$ per cent of the tea. The cellulose constitutes a great part of the tea-leaves which are left after pouring off the infusion.

Tannin and
Other
Constituents.

An idea of the proportions in which the various ingredients exist in tea will be gathered from the following analyses of Congou and Young Hyson. These were selected as being fair representatives of black and green teas.

			Congou.		Young Hyson.	
Theine ...	...	...	3.2	per cent	.....	2.3 per cent.
Albumin ...	...	...	17.9	"	.....	17.6 "
Tannin ...	...	...	16.4	"	.....	27.1 "
Pectin and gum	...	...	2.6	"	.....	3.7 "
Nitrogenous extract	...	...	6.8	"	.....	7.1 "
Resin and chlorophyll...	...	...	4.6	"	.....	4.2 "
Cellulose ...	...	...	34.0	"	.....	25.9 "
Moisture ...	...	...	8.2	"	.....	6.0 "
Ash ...	...	...	6.3	"	.....	6.1 "
			<hr/>		<hr/>	
			100.0		100.0	

In the days of high-priced teas there were probably few articles more frequently adulterated. The sophistication was carried on both in China and in this country; but for many years past any adulteration that has been practised has, it is safe to say, been effected almost entirely before the tea has reached these shores. The spurious teas manufactured in this country were composed sometimes of exhausted tea-leaves, and sometimes of the leaves of other plants, such as the elder, the sloe, and the willow. When made up to resemble black tea, the leaves were slightly coloured with Dutch pink to impart a bloom; and for imitating green tea they were prepared with such substances as Prussian blue, French chalk, indigo, magnesium carbonate, and calcium sulphate. The Chinese sophistications most frequently consisted of partially-exhausted leaves, and of leaves made up with a large proportion of sand by the aid of a little gum, and then skilfully rolled and re-dried so as to resemble ordinary commercial teas. Plumbago was usually employed to give uniformity of colour to black, and a mixture of Prussian blue and soapstone to green teas.

At the present day there is no such gross and frequent adulteration practised. Foreign leaves, excess of sand, and colouring matters for "facing", are now of seldom occurrence. When foreign leaves are suspected, a microscopical examination of the tea suffices to detect them. Sand, quartz, and magnetic oxide of iron, which in the past have often been found in tea as adulterants, are discovered by the excessive amount of ash which is left when the tea is incinerated, and by the further analysis of this ash. A magnet drawn through the tea will remove the

magnetic oxide. The ordinary amounts of ash given by genuine tea will be gathered from the following table:—

Tea.				Ash.	
Shanghai Congou, common	...	...	...	7.6	per cent.
" fine	...	...	...	7.4	"
Moyune Young Hyson, common	...	...	...	7.5	"
" " fine	...	...	...	7.5	"
Moyune Hyson, common	...	...	...	6.5	"
" fine	...	...	...	6.9	"
Foochow Scented Orange Pekoe, common	...	...	...	7.2	"
" " fine	...	...	...	6.7	"
Foochow Souchong, common	...	...	...	6.4	"
" " finest	...	...	...	5.9	"
Canton Scented Caper, common	...	...	...	6.4	"
" " fine	...	...	...	6.6	"
Foochow Moning, common	...	...	...	6.9	"
Assam Orange Pekoe	...	...	...	5.9	"
Indian Pekoe Souchong	...	...	...	6.3	"

These quantities are of course subject to slight variations, but it is generally reckoned that the ash of genuine tea should not exceed 8 per cent.

Colouring matters used for facing tea are best detected by shaking a portion of the sample up with cold water, and pouring off the liquid into another vessel before the detached particles have had time to subside. After these particles have settled down in the second vessel the water can be poured off, the sediment further examined, and, if desired, dried and weighed to determine its amount. If the facing was Prussian blue, its colour will be destroyed on adding a little potash solution to it, and restored again with a little hydrochloric acid.

Used tea-leaves, which have often been employed to adulterate tea, are detected chiefly by two methods. (1) Since the first infusion with water has extracted a good deal of the mineral matter, the exhausted leaves have a smaller amount of ash than genuine tea has. Thus instead of being 6 to 8 per cent, the ash of used tea-leaves is only about 4 to 5 per cent. Consequently, when any considerable quantity of used leaves is mixed with genuine tea, the ash of the mixture is proportionately lower. And the amount of the ash soluble in water is less still. (2) The first infusion has extracted a large quantity of tannin, theine, and other organic matter from the used leaves. Therefore on making an

infusion of the mixture adulterated with exhausted leaves, the amount of such organic matter is less than it should be if the sample were genuine. This is tested in practice by taking the "specific gravity" of the infusion of a suspected sample. The more matter there is in the infusion, the greater its specific gravity, and *vice versâ*. Thus the specific gravity of a "1 in 10" infusion—*i.e.* one ounce of tea boiled with ten ounces (half a pint) of water—ranges from 1010 to about 1014 for genuine tea; whereas for used leaves it ranges from 1002 to about 1004. Consequently a mixture of genuine and used leaves will give a figure lying between the two extremes. When the sample consists wholly or largely of used leaves the detection is very easy; but it is much more difficult when only small quantities of the exhausted leaves are used as an adulterant.

A test for used leaves mentioned by a French journal consists of throwing the suspected sample into a solution of acetate of copper. Fresh tea will in two days give a greenish colour, whereas tea that has served will not. This, however, is not quite certain. The colour has been obtained even with tea that has been infused several times. The French paper prefers the reaction recommended by Dr. Nestler. "Powder the tea between the fingers and place it in the centre of a watch-glass, cover it with the same size of glass and warm gently. There will be formed on the top of the glass certain little bodies. After warming for ten minutes you will see, besides these, little bodies of theine crystals visible to the naked eye, and better still with the microscope. You can make sure of the identity of these crystals by treating them with hydrochloric acid and a solution of chloride of gold. Prisms more or less yellow in colour are formed, silky, long and slender, of quite peculiar character."

Maté or Paraguay "Tea" is the dried leaf from the shrub *Ilex paraguensis*, commonly known as the Brazilian Holly. In the early spring branches of this plant are gathered, piled upon the ground, and partially dried by great fires that are built near; afterward they are spread upon frame-work a few feet above the ground, and subjected to a curing process from the heat and smoke of the fire built underneath. Arabian Tea or Kat is sun-dried leaves of the *Catha edulis*, much esteemed by the Arabs for beverage purposes. In Australia leaves from the climbing

vine *Smilax glycyphylla* were used by early settlers as tea. "Cracker" or "Sassafras Tea" consists of the fragrant bark from the root of a native American tree belonging to the laurel family. Tea from Sassafras roots was and is still used by the poor whites and negroes of the South. In New Zealand a so-called "tea" is made from a small shrub of the myrtle family, the leaves being picked and carefully cured. In Labrador small branches of an evergreen shrub are dried and used in making "Labrador Tea".

It may be of interest to mention that in the United States tea is inspected on importation, and if it fails to come up to certain standards is at once re-exported or destroyed. Tea
Inspection. The standards are fixed by a board of merchants selected by the Secretary of the Treasury each year from all the principal tea markets of the country, and are revised yearly to meet the changing conditions of the trade. Tea can only be imported at Chicago, New York, San Francisco, St. Paul, Tacoma, and Honolulu. The tea is examined for purity, quality, and fitness for consumption. It has been advocated that a similar system of inspection should be adopted at British ports.

The following are the weights of the packages of tea of various descriptions, as arranged by the London port authorities for their official record of stocks, &c.:—Congou, chests, 106 lbs.; Weights of
"Originals". half-chests, 61 lbs.; boxes, 20 lbs. Souchong, chests, 90 lbs.; half-chests, 50 lbs.; boxes, 17 lbs. Scented Caper, boxes, 21 lbs. Scented Orange Pekoe, boxes, 20 lbs. Oolong, half-chests, 44 lbs.; boxes, 19 lbs. Flowery Pekoe and Sorts, chests, 60 lbs.; half-chests, 44 lbs. Twankay, half-chests, 47 lbs.; boxes, 12 lbs. Hyson, half-chests, 58 lbs.; boxes, 17 lbs. Young Hyson, half-chests, 65 lbs.; boxes, 25 lbs. Imperial, half-chests, 60 lbs.; boxes, 34 lbs. Gunpowder, half-chests, 66 lbs.; boxes, 37 lbs. Assam and Indian, chests, 96 lbs.; half-chests, 53 lbs.; boxes, 21 lbs. Ceylon, chests, 94 lbs.; half-chests, 50 lbs.; boxes, 18 lbs. Java, chests, 70 lbs. Japan, packages, 65 lbs.

In 1906 it was estimated that there were quite 600 "marks" of Ceylon and nearly 650 of Indian tea. It will be readily understood, therefore, that amongst so many producers and "gardens" there is much disparity, while, of course, the varying conditions of climate from year to year affect uniformity. Good judges consequently assert that to judge value by marks is hopeless.

3. TEA-BLENDING

As late as the last quarter of the nineteenth century a grocer and tea-dealer who considered himself master of his trade would almost have thought himself insulted if advised to buy blended teas from a wholesale tea-dealer. The professional tea-taster was then something of a *rara avis*, and a well-trained grocer was apt to think he knew as much about tea as there was to know. In the wholesale trade, however, the man with a palate commanded a large salary. To-day there are plenty of men with palates, and the salary, it is to be feared, is in proportion. There are still grocers and tea-dealers who prefer to buy "originals"—who know their trade and who please their customers better than general blenders can do. But the retailer who has not a fairly large turn-over is out of the running if he tries to blend his own teas—he has to keep too large stocks, and cannot take advantage of the turns of the market unless he has capital. Moreover, it is an important matter, in buying teas for blending, to buy at the right moment—to be able to procure the teas that suit at the time when they can be bought well.

China, Ceylon, and Indian teas of various growths—and especially Darjeelings—need careful watching if they are to be bought well; the suitable kinds very soon find their way into private hands. Consequently the buyer of "originals" must not only have the knowledge to enable him to buy, but the capital at command to give effect to his decisions when they can be made.

Thus the advice to be given on the great question "To blend or not to blend?" would seem to be, that the retailer who makes up his mind what blend to cultivate, and who knows how and when to make his selection and has capital to take advantage of the markets in various stages and phases, should follow the old traditions, and then the extra stock he has to keep and the capital invested can be made to pay, if he is well up in his business; but the ordinary "single-shop" tea-dealer who can buy for cash, who does not go in for meeting the various shades of palate which prevail among his public, will undoubtedly do better, if he can pay cash, by selecting the blend that suits him, and then sending samples to the blenders he has confidence in, asking them to match his blends, and buying those that give him

the best value. Competition is nowadays so keen, that undoubtedly good value can be had from the wholesale blenders. "I think it may be laid down," writes an old and successful grocer of great practical experience in this particular matter, "that a man who buys less than six chest lots, and those rather frequently, should not in these days attempt to blend. He cannot do with small stock and small purchases, say less than six, at $4\frac{1}{2}d.$ and duty, = $10\frac{1}{2}d.$ (to sell at $1s.$); six each of Ceylon and Indian (and flavouring teas extra) for $1s. 4d.$, to cost $6\frac{1}{2}d.$ and duty; ditto for $1s. 6d.$, cost $8\frac{1}{2}d.$; and six at $1s. 0\frac{1}{2}d.$, for $2s.$ Here are fifty chests, to say nothing of Capers, Pekoes, Oolongs, &c., for flavourings. Add Moyunes Gunpowders, &c., and you have altogether a hundred chests which must be in the tea-room, besides apparatus for blending, which runs into capital. On the other hand, the grocer who does not blend can, if he goes about it rightly, buy well with three chests for each blend—say $1s.$, $1s. 4d.$, $1s. 6d.$, and $2s.$, making a total of twelve chests in all; and thus working with one-eighth of the stock he would require so much the less capital, to say nothing of avoiding the dusty work of blending and the waste of time in tasting 'originals'. Consequently, for those who are starting in the tea trade, and who are in doubt whether to blend or to buy blends, the practical advice is—at all events *begin by buying blended teas*, but learn what is likely to suit your customer, and be sure that you *watch*, and taste what blenders send you. Large blenders have, of course, many and great advantages, and they can buy and use teas which small men cannot touch without great danger. It is to be feared that assistants nowadays have not much opportunity to be taught the tea trade, and many would not care to be taught if they could be. The writer, who was in the trade when China teas only were imported, and has seen the growth and cultivation of Indian and Ceylon and Java teas, is almost dumfounded as he, in writing this, reflects on the past fifty years of change in methods and prices. Common Congous (wretched stuff), costing $1s.$, with duty $2s. 2\frac{1}{4}d.$, did not in the old days produce a very choice tea even at $4s.$ a lb. retail; whereas nowadays a tea very much more drinkable can be and is retailed at $1s. 2d.$ "

Assuredly this is wise advice from our experienced friend; yet there are grocers in different stages of progress and differently

Practical
Advice.

situated as regards capital, to say nothing of enterprise, and we may be quite sure that not a few of the readers of these pages will desire to master their trade in this important particular of the art of tea-blending. Let us see, then, in the first instance, how the tea-blender goes about his business.

To begin with, he must be familiar with the characteristics of different kinds of tea. We cannot render him much practical assistance by merely writing of these characteristics. Know Your Teas. Books have been published concerning them, and new books might easily be written; but after reading them all, the reader who desired to know the teas and use them in practical blending would, like the claret-drinking farmer, be little "forrader". Perhaps the best way to learn would be to procure from a reliable wholesale house or two a full range of samples, or as full as can be obtained. Then examine and compare these in the minutest possible way, and try to describe them in a note-book of your own, so as to be able to form some mental picture and memory of their various qualities. Teas differ in appearance, smell, and taste in the leaf itself; and when "liquored" or brewed in the proper way with water, they again have their characteristics in colour, depth of colour, aroma, fragrance, taste, and strength. All these characteristics are duly noted with the most minute care by the professional taster.

This gentleman's outfit consists of a number of teapots and flat-shaped cups, a pair of scales and a half-ounce weight, a silver spoon rather larger and deeper than the ordinary tea-spoon, and Tasting Tea. a kind of sand-glass like an egg-boiler or hour-glass, but arranged to run out in five minutes, or in some instances six. Filtered, or sometimes even distilled, water is used; the tea is carefully weighed; the water is boiled up at once after being drawn, and is poured on the tea the moment it comes to the boil—overboiled water won't do; and the tea is allowed to stand a fixed time. What this time should be is a question on which opinion is not entirely unanimous; some say three minutes, some five, some six, and some ten. But the truth is that different teas require rather different allowances of time for the extraction of their qualities; and we should note that some qualities are extracted in a certain time and others in a longer time. In blending this has to be carefully thought out,

A TEA-TASTING ROOM

The illustration shows the interior of one of the tea-tasting rooms to be seen in the wholesale houses of Eastcheap and its neighbourhood. The operations of tea-tasting are described in the text. By way of comparison we may quote the following description of the method of tea-tasting in the American tasting rooms:—"We use tiny cups of perfectly pure material, white, almost porcelain-like, without ornamentation and minus any handle or lid, being made of the finest French ware, and rather thin. We weigh the tea fractionally and gingerly, just a finger-pinch to each cup; for more would make it too tannin-like ere it cooled sufficiently for tasting. The cups are set out in rows, and their identity denoted by tickets or adhesive labels under them. They are interchanged upon the board and the freshly-boiled water brought into play. We are very careful to note the 'agony' of the leaves as we watch the delicate liquoring, and also the bouquet and flavour of the tea. These are our guides to the matching of values, and the art of tasting teas; and they are unfailingly sound. There is no letting the tea stand five to seven minutes till you've nothing but tannin to taste, and thereafter separating the liquor from the leaves."

we have endeavored to give a full and complete description of the various characteristics of the different wines, and to show the reader how to select the best quality of wine for his own use. The following is a list of the various wines which we have tasted, and the characteristics of each.

The first wine which we tasted was a French wine, and it was of a very fine quality. It was of a deep red color, and it had a very pleasant taste. It was of a very fine quality, and it was of a very pleasant taste.

A TASTING ROOM

The illustration shows the interior of one of the tasting rooms.

The room is of a very fine quality, and it is of a very pleasant taste.

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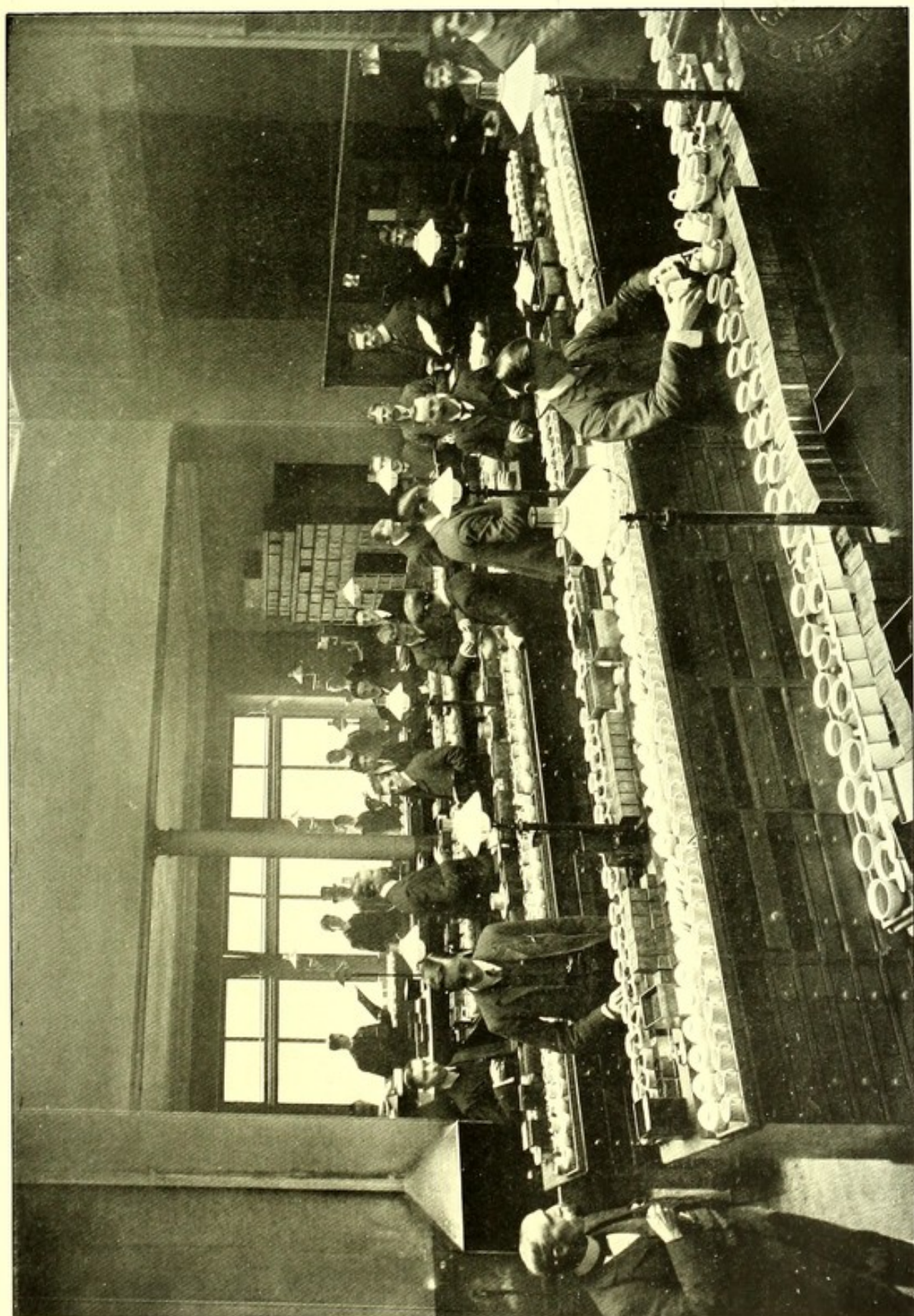
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INTERIOR OF A TEA-TASTING ROOM

London Stereoscopic Co.



because you have to reflect that the ordinary public will make the tea in the ordinary manner, and your blend must be arranged accordingly, so that its flavour will not be spoilt by the tea being made in a way different from that which you employed in tasting the several ingredients.

The tea having been infused, say, six minutes, you note the colour carefully, you inhale the odour, and you taste the liquid; but do not swallow it, since doing so is apt to render the nerves of the palate less acutely sensitive to the taste. Of course no sugar is added to the tea for tasting, though there is no reason why the blender who is experimenting should not try the effect with milk, and also with sugar. Your great object is to suit the taste of your customer, consequently you must try to make the tea as she will make it, and note what effect it is likely to have upon her palate. You wish to give her something which, made with the water she will use, will please her; secondly, you wish to sell a tea which has its distinctive characteristic, so that it can be identified as yours if successful; thirdly, you wish to be able to provide that particular kind of tea with un-
Objects in Blending.
varying regularity, yet with as little demand upon your own pocket as may be. These will be the objects in your blending, therefore the need for carefully studying the water, &c., in tasting your originals. After the actual tasting, comparing tea with tea, and noting the character, the leaves themselves in the cup are examined and their characteristics are noted. In short, in tasting teas every possible criterion is used, and the skill the professional taster acquires by long practice is marvellous.

Having familiarized himself with the different kinds of tea individually, our would-be blender has to find out which will go together to produce the best effect. He will discover very soon that the stronger flavour kills the more delicate, so that he may be wasting a costly fine-flavoured tea by mixing it with a stronger one unless due proportion is observed between the two. Or the flavour of the blend may be quite different from either of the kinds in it tasted separately. Here, therefore, is scope for a whole series of further experiments in different combinations; and throughout these our experimenter will go to work on proper scientific principles, using exact weights, time, and methods, and duly noting the results for future guidance.

Finally, having learnt (*a*) the characteristics of teas individually, and (*b*) the characteristics of different combinations, he comes to his experiments for the actual blends he proposes to sell. Here, of course, he will have regard to the local peculiarities of his trade, his customers' likes and dislikes, their taste as to scented or non-scented tea, their habits in making their tea, the water they will use, the price they will pay, the colour they prefer—strong and dark or light, and so on.

To start with, a grocer has to find out whether the water in the neighbourhood where he is to supply his tea is "hard" or "soft". Certain kinds of tea will come out coloury in the cup and others thin in his particular district; and which of these it will be experience only can teach him, one can lay down no law on this point. For instance, a London dealer goes into the public auction and buys a tea on his London-water tasting, because it is strong and coloury in cup, and will just suit an enquiry he has got from his Manchester agent; yet that sample may be rejected by Manchester, *because* it is thin and hardly colours the water; and, *vice versa*, a thin tea in London may come out thick in Manchester. "This I have often proved", writes a practical tea-blender, "by tasting the same tea infused at the same time at the office, one pot with London water and one with water sent in a jar from Manchester—the one coming out dark, and the other pale in colour but pungent." The London water, it may be remarked, is generally a medium water, and most teas will suit it. But other waters are widely different. It is possible to buy a map showing the characteristics of the water—hard, soft, medium, and so on—in various parts of the country, but exact local knowledge may be obtained, and is, of course, preferable.

The all-important point in tea selection and blending is to see that each tea is suitable for the water of the district in which it is to be used. It is unsafe to rely upon marks or "gardens", as the teas vary from year to year, and show variation in character even in the different packings of the same season.

Hardness and softness in water affect its extractive power on tea. Pure water, as most people know, is composed of eight parts of oxygen and one part of hydrogen. It is, however, impossible to find a town which has a really pure water. In

some parts of the north of Scotland, where the water flows over hard rocks, it is found to be exceedingly pure. But it is quite a mistake to suppose that brightness is a sign of purity; on the contrary, it is generally a sign of impurity. All spring water is, as a rule, bright and sparkling, but it is the most impure of all kinds of water, because it contains a larger proportion of mineral matter. Rain-water is the purest water, then comes river-water, then the water of lakes, and lastly spring-water.

It will be easily understood why it is necessary that the blender should be acquainted with the quality of the water used to infuse his blends. If the water be hard it would be a mistake to compose a blend of fine soft liquoring teas, for the flavour could not be sufficiently extracted; and this, of course, means a waste of tea, and therefore a waste of money. The thing to aim at is to make a particular blend for a particular water, so that this water may extract every good quality out of the blend and allow nothing to be wasted. Utilize every good quality of a tea, and if two teas blended together are not superior to each of the component parts, do not blend them.

As teas that ought not to be used too freely for *hard* water, a practical letter to *The Grocer* some years ago mentioned Lap-seng Souchongs, fine Pekoe Congous, honeysuckle-
 flavoured new makes, Keemuns, Kintucks, Ning-
 chows, Kangra Valley teas, and all fine-flavoured Darjeeling
 and Neilgherry teas. Teas with fine delicacy of flavour should
 be blended freely for soft water; while thick, strong, or rasping
 teas, such as Oonfas, Ichangs, Saryunes, Padraes, thick Soomoos,
 Moyunes, burnt Ceylons, and all strong Indians will be found
 most suitable for hard water. There are some districts where
 the water is neither very hard nor very soft. Soomoos, Kin-
 tucks, Keemuns, Ningchows, Panyongs, most Ceylons, Dar-
 jeelings, Cachars, Sylhets, and Assams may be used, but it is
 difficult to lay down any specific rules, as teas are so different
 in degrees of strength and flavour, and so much depends upon
 the taste of the consumer.

One thing a blender must bear in mind is, that a fine flavoury tea must not be used with a rough tea, for the rough tea will absorb and drown the flavour of the fine tea, and the result cannot but be a loss. Fruity and tarry teas are very often

useful, but they must be used very carefully, and as quickly as possible, for they are not good-keeping teas. When Scented Caper is used, all the other teas should be thick and strong, otherwise the infusion will come out thin. Scented Pekoes, when employed, should go in a proportion of 1 to 16 or 18, but it is best for beginners to steer clear of Pekoes altogether, for many a blend is spoilt by an injudicious use of them.

The public as a rule want a tea that in the cup is dark in colour. In the Midlands, Manchester, Liverpool, and the mining districts they seem to like a strong pungent liquor, and Souchong Capers and strong Assams are greatly used. For hard water strong and pungent Assams are recommended. Ceylon teas are full of flavour, but soft. Whole-leaf Pekoe is used for a light, fine flavour, and broken Pekoe to bring up the colour, with perhaps some Assam Pekoe and Pekoe Souchong to give an edge or point. A Darjeeling tea (Indian), about 9*d.* to 1*s.* (1903), is a nice brisk and flavoury tea, very useful to blend with Ceylon for a more refined taste. Finest Darjeelings are very choice teas, and enormous prices are paid for them by Scotch and Irish buyers, and also by retailers, who sell a *fine blend* at 3*s.* 6*d.* to 5*s.* per lb. Finest Formosa Oolongs (Japan) are also used in these blends, and have a flavour of the peach. Fine Ceylons, Darjeelings, Kintucks (China) are most suitable for soft water. Ceylon and Indian broken Pekoes and dusts are very thick, strong, and coloury; they generally cream over when getting cool, and appear as though milk had been added. They are used carefully with whole-leaf tea, not enough to make the blend dusty, but to make up the colour.

There are some large distributors of teas who will have none of the China teas. They say that even a tenth part is detected, and is not liked by the public. This, however, is a rather absurd position to take up. A good plan is to use plain useful Monings as a basis. This tea will keep a year, and will absorb the strong flavour of Indian and Ceylon and "hold it together", whereas Ceylons lose their flavour in a few weeks, and are only bought and sold just enough for the week's requirements, as they come in fresh all the year round.

Note that Indian teas have their season for making, and that

it begins in May and ends in September for good leaf (blackish), while the last lot of the season has an autumn flavour, Seasons in Teas. generally reddish in appearance, and very flavoury. As there is only a little of this tea the ordinary blender is afraid to buy it, as it is impossible to "follow" for another year, so that he might not be able to keep up that particular flavour in his blends. China tea is nearly all *first crop*. It is made in *May*, and keeps its flavour for a year, and is all sold off at once in China, being all in here between July and September. If there is likely to be a demand for London, some second and third crop teas are made, consisting of plain, useful fivepenny or sixpenny grade teas, but the bulk of these are taken for Russian consumption, and only a small quantity comes to this country, to meet the demand when the Indian and Ceylon crop is short, and low-priced tea is required to help out the dealers for "shilling canister" purposes.

The main points in good tea-blending are: (*a*) regularity of leaf; (*b*) flavour; (*c*) body or fulness; (*d*) regularity of style. All who wish to keep and increase their tea trade must recognize the necessity of regularity of style. Tea-drinking is undoubtedly an acquired taste, and the blenders are entirely responsible for the different tastes of different districts. If the taste of certain districts is bad, it can be traced wholly to the blender in the first instance. Regularity in style is most essential, and if a blender thinks it necessary to change the style of his blends, he must do so gradually, and so carefully that the ordinary consumer is unable to detect the process. The taste of the consumer varies very considerably in different districts. An expert in the wholesale tea trade writes:—"The Irish and Scotch buy the finest teas, and pay the longest prices. The Irish poor *will* have the *best*. The English like plenty for their money, and a cheap price is the housewife's guide and object. The bulk of the English public seem to have no palate, or else not to care what they drink, so long as it is strong to the *eye* when in the tea-cup." This is perhaps a little sweeping, for nowadays the taste of the public is probably a good deal more discriminating than it used to be.

National
Character in
Tea-drinking.

The appearance of the tea in leaf must be considered to some extent. People judge tea by its look more than grocers some-

times suppose. Some, especially in the south of Ireland, like a "pretty-looking" tea. For such, Assam Pekoes, broken Orange Pekoes, and Ceylon broken Pekoes, which have a lot of tip (flower) in them, are chosen; those with golden (*i.e.* yellow) tip are much more valuable than those with white, or "silver", tip. For the sake of the appearance of the dry tea care must be taken to keep the tea as far as possible free from dust, yet dust is often the most useful element in producing a good appearance of the tea when liquored. Where teas of irregular appearance are used, sift them before putting into the mixer, to remove the large leaves, which should be cut to gauge in a tea-mill, or broken through a sieve, before being placed in the mixer with the rest of the blend. In order to give the dry leaf a good appearance it is often found advisable to mill those teas which are large and ugly. Not only does milling the large-leaf teas improve the appearance of a blend, but it spreads these teas more equally over the whole blend, and thus makes the taste more regular. Large-leaf Pekoes, Pekoe Souchongs, Souchongs, China Souchongs, Oolongs, and Canton Pekoes are generally the teas that require to be milled. The milling is done by a machine or mill, of which various kinds are in use, varying in cost from a few pounds to a great many. Some of these mills are fitted with appliances for automatically removing from the tea such interlopers as nails, which are rather apt to find their way into it from the chests. In the larger mills used by the wholesale blenders electro-magnets extract all the nails, screws, pieces of hoop-iron, and so on, and sieves remove other obstructions, while electric weighing-machines automatically weigh the tea as it passes through. Our grocer-blender will not need to expend his capital upon such apparatus—until at any rate he has got a little beyond the preliminary stages of his tea-blending business!

Whilst considering the taste of his particular circle of customers, and perhaps falling in with it at first, "matching" the teas of his competitors rather than attempting to improve upon them by making radical changes and bold new departures, our grocer will nevertheless aim at giving his blends a distinctive character if he finds he can do so. The aim of the smart houses is to produce blends which customers cannot obtain elsewhere,

for when once customers have become used to a grocer's tea and appreciate its distinctive flavour, they like to stick to it, and therefore to him. This is the secret of success with most of the best-known blends and blenders, and it is a point grocers must give their attention to if they wish to succeed, although too often the grocer of the ordinary type attempts nothing of the kind. To give your blend a character of its own, and differentiate it from that of your neighbour, you have to introduce into it some striking ingredient—striking enough to please your customers, not to excite their dislike! “There are many ways of doing this—by giving prominence to some Indian garden of marked character, or by introducing autumnal tea, or using in small quantities (about an ounce to a pound) Namuna tea, Ceylon Oolong, Canton or Foochow scented tea, or Formosa Oolong. Each of these teas has its own distinctive qualities, and combinations of them give scope for a practically endless blending. Scented teas are often used most unwisely. For ordinary purposes one part in twelve, or even one in sixteen, is quite sufficient to give the blend a distinctive flavour. Fine Ceylon, or Formosa Oolong, or Foochow Pekoe are the most desirable kinds for the purpose. Of course the above applies to ordinary trade. There are districts where people drink a mixture of one part Caper and two parts pungent broken Assam, and appear to like it.” In introducing these distinctive elements the greatest discretion must be exercised. You do not want an advertisement in your disfavour!

By way of affording our readers a guide in this important matter of blends, we have been at some little expense to secure specially for this work some copies of formulæ which have been in actual use in a very large house, though not representing those teas with which the public is familiar through the advertised packet system:—

A. (Fine China tea blend.)

4 parts Moning (Kintuck)	} nominal cost, 1s. 8½d. duty paid.	} to sell at 2s.
1 part Darjeeling (pure flavoury kind)		

B. (Finest China blend.)

Fine Kintuck or Ningchow	} 2s. 6d. to 2s. 8d.
½ Fine Formosa Oolong	...	...	...	...
⅓ Darjeeling, or fine “pure” flavoured Ceylon	...	...	...	...

A Distinctive
Tang.

Suggested
Blends.

C.											
$\frac{2}{3}$	Good Ceylon Pekoe, to cost 8 <i>d.</i> to 9 <i>d.</i> , and duty ...	...	...	...	...	}	1 <i>s.</i> 10 <i>d.</i>		
$\frac{1}{3}$	Good Indian Pekoe, to cost 9 <i>d.</i> to 10 <i>d.</i> , and duty ...	...	...	...	...		
D.											
4	Indian Pekoe ... ..	...	...	...	...	}	to cost 1 <i>s.</i> 2 $\frac{1}{2}$ <i>d.</i> duty paid.	}	1 <i>s.</i> 8 <i>d.</i>
1	Indian Pekoe Souchong						
4	Ceylon						
1	China Congou (Moning)						
<hr/>											
10											
E.											
4	Indian ... ..	...	...	...	...	}	to cost 1 <i>s.</i> 1 <i>d.</i> duty paid.	}	1 <i>s.</i> 6 <i>d.</i>
3	Ceylon						
1	China Moning						
<hr/>											
8											
F.											
3	Indian Pekoe Souchong	...	...	...	...	}	to cost 5 $\frac{1}{2}$ <i>d.</i> to 6 <i>d.</i> , and duty in ordinary market.	}	to sell at 1 <i>s.</i> 2 <i>d.</i> to 1 <i>s.</i> 4 <i>d.</i>
2	Ceylon Pekoe Souchong						
3	China Moning						
<hr/>											
8											
G.											
40	Ceylon Pekoe flavoury ... ..	...	...	...	...	}	to cost 11 <i>d.</i> and duty.	}	to sell at 1 <i>s.</i> 9 <i>d.</i> to 1 <i>s.</i> 10 <i>d.</i>
20	Ceylon Pekoe thick						
20	Indian Pekoe thick						
10	Indian Pekoe flavoury						
10	China Congou (Kintuck)						
<hr/>											
100											
H.											
5	Indian thick flavoury ... ..	...	...	...	...	}	to cost 7 $\frac{1}{2}$ <i>d.</i> to 8 <i>d.</i> and duty.	}	to sell at 1 <i>s.</i> 6 <i>d.</i>
1	Darjeeling						
2	Ceylon broken Pekoe, fine						
2	Ceylon Pekoe						
<hr/>											
10											
I. (Special Ceylon blend.)											
1	Ceylon broken Pekoe, fine	...	...	...	...	}	to cost 10 <i>d.</i> and duty.		
1	Ceylon broken Pekoe, thick	...	...	...	...		
1	Ceylon Pekoe, flavoury ...	...	...	...	...		
1	Indian Pekoe, fine ... ..	...	...	...	...		
<hr/>											
4											

The prices of these blends are based on an ordinary market value (1903), although, while from 7 $\frac{1}{2}$ *d.* upwards the prices are normal, the lower blends quoted would at the time of writing

require adjustment as regards price, as the public sale-value of course varies from time to time.

It goes without saying that an enormous variety of blends can be made with a by no means large range of teas, just as a vast number of tunes can be played with seven notes. Blending Experiments. The amateur blender should experiment for himself, and note results. For instance, mix an ordinary pleasant-tasted blend, and try the addition to it (for distinction's sake) of a little Scented Pekoe, Assam, or Golden Pekoe. In short, try a good many combinations, and do so with intelligence and a note-book, and you will hardly fail to improve your tea education, even if you do not hit upon anything better than you can buy ready-blended at the same price. Whilst it may not pay you to blend the whole range of your teas, it may easily pay you to have one or two special blends of your own, and buy the rest blended.

The ingredients of your blend having been selected (we have already mentioned the milling of such as need it), the next step in the actual blending is to get them thoroughly assimilated. This is partly done by mechanical means Mixing and Storage. and partly by the tea itself. Tea-mixers of all capacities and various kinds are in use; some will mix 50 lbs., some 5000 lbs. The tea-mixing machine distributes the various teas in a fairly even proportion throughout the bulk; but this does not complete the mixing. To render the assimilation thorough and complete the blend must now be put in air-tight canisters and allowed to remain in a room, with as even temperature as is possible, for at least a week. By this time the interchange and combination of the flavours of the various ingredients will usually be accomplished, but in some instances it will be found to be advantageous to allow the blend to mature for a longer period. It is best to keep the tea in a warm place, as the heat spreads the flavour of one tea through another, and gives the uniformity which is required.

In the wholesale blending trade the tea-tasters earn large salaries. A blend of tea may require any number of different varieties, from two up to twenty. The taster, having Wholesale Blending. decided on the blend, writes it out in the instruction-book, from which the mixers are required to work. On the top floor of the building the various teas are placed in their proper proportions in a wooden hopper; when this is full a slide at the

bottom is drawn, and the tea falls into a hollow sphere of iron, which revolves slowly on a central axis, the tea being mixed by the resistance of a set of blunt knives fixed in the centre. Each load is allowed to revolve for twenty-five minutes, and is then discharged through a wooden shoot into bins on the floor beneath. From these it is taken, weighed, and placed in smaller receptacles, holding about 150 lbs., and allowed to stand for seven days in order that the flavour may assimilate. The bins of tea are then removed to the packing-room, where they are placed above the packing-bench on a sloping platform. The process of packing is performed by young employees; the weigher scales out the tea from the bin, the folder makes packets of the requisite size, into which the packer wraps the tea. The labelling, which is the last process, is usually performed by women.

We have remarked that in the process of tea "assimilation" a warm temperature assists. But be very careful where your tea is placed, for if it stand near any strong-smelling articles it will absorb their flavour. Thus fine teas are often ruined by contact or proximity with soap, cheese, or onions in a grocer's stock. It is wonderful how absorbent tea is in this way. Consequently it is of the utmost importance that your tea be kept in a dry and suitable place. It should be kept always in a crisp condition. An air-tight steel bin is useful, as air spoils it.

Upon the practical work of tea judging the subjoined advice by trade experts is to the point:—

Leaf that is closely twisted generally gives a better second cup; whereas open, flat leaf infuses very quickly and all the tea's essence is extracted with the first water. In districts where the water is hard, closely-twisted leaf should be chosen, but in districts where the water is soft, a more open leaf may be selected. The leaf should not contain an undue proportion of small, as in the cutting of the leaf and blending of the tea, a certain amount of small tea is made. The leaf with a brown shade is generally the best-liquoring tea; black, pretty leaf generally gives a poor liquor. The infused leaf is generally a clear indication as to quality and character. Yellow leaf with a greenish shade generally denotes "pungency". Rich golden leaf invariably denotes quality and high grade. Reddish infused leaf denotes rich, full liquors. Dark infused leaf is a

More on
Storage.

How to
Judge Tea.

sure indication of low-grade and common tea, and should be avoided. By practice, and careful observation and comparison, one is able to distinguish variations in character of infused leaf by the smell, and to easily detect "point" and "pungency", "thickness", "richness and body", "burnt", or "over-fermented" teas. Now we come to liquoring. This is the only real test of "quality" and "flavour". The ideal tea is the brisk, full, rich, flavoury tea, thick in the cup, although not dark, but rich in colour. When milk is added, its characteristics "come well through". It is essential, for the final tasting, to add milk; many thick-looking teas are only "coloury", and, when milk is added, are tasteless and watery. Good tea will always look rich and full, with a reddish-golden tinge in the cup; this is the ideally perfect colour.

We must remember that the consumer measures, not weighs, tea into the pot; therefore, if too large in leaf, it will be too little by weight, and a thin liquor will result. Small dusty tea is also to be avoided for obvious reasons. Small tightly-
Tea
Tasting.twisted leaf, crisp to the touch and sometimes fragrant to the nose, is desirable, and if on "nosing" it (or smelling it after breathing into it) we find it is not burnt from over-firing or tarred from being smoked, or, worse still, sour from over-fermentation (which is the most serious evil of the three), we can then proceed to the final and only certain test, that of tasting. The best time for this is in the morning, when the palate is clean and fresh; and if we banish alcohol and tobacco, sweets and spices from the daily dietary (for it is as necessary to train the palate as the muscles) we shall with practice find our sense of smell and taste will make our judgment comparatively easy. We are now ready to weigh up our teas into china or earthenware pots, being quite sure that these are perfectly clean, and that all traces of tea from the last tasting have been removed. A weight of leaf equal to that of one farthing is infused, but care must be taken to weigh the tea evenly. It is quite easy to obtain at least three different results from the same sample by weighing in the large and small, and a mixture of large and small separately. What we desire is to obtain a fair sample of the bulk in our tasting-pot. Our next care is to see that the water we use is well up to boiling point, but it is of equal

importance that it is not overboiled, as both are practically useless for extracting the best qualities from the leaf. (When a blue film comes over the water it is right; when the water becomes gray or white it is overboiled.) This is a point often forgotten, and certainly not understood by the consumer. After the tea has been infused for six minutes, the theine in it has reached the point at which its delectable qualities are most pronounced, while the tannin has not yet become active or apparent to the taste. For the next few minutes there is no apparent change in its condition, but at the end of ten minutes rapid deterioration begins. The theine becomes momentarily weaker in taste, the delicate flavouring disappearing. At the same time, the tannin just as rapidly takes precedence, and the bitter taste becomes increasingly pronounced. Bear this in mind, not only in tea tasting, but keep it well to the front in talking about tea to your customers, for in this connection the consumer requires all the knowledge you can give him. To return to our tasting. The liquor must be poured off and drained, after which the infused leaf should be turned on to the top of the lid and carefully nosed and inspected. This test should always be applied, as it is often possible at this point to detect defects which are passed in nosing the dry leaf. The colour of the infusion should be a rich copper brown or approaching to olive, and as a general rule the blacker the infusion the worse the tea. We now come to our final test, that of tasting, and here it is easiest to judge the quality of the liquor when it is sipped at the right temperature. Tasting tea too hot means destroying the palate, and, speaking from my own experience, I should say that the best time for tasting is when the temperature of the tea is a little higher than that of the body. Care must be taken to expectorate immediately after sipping, otherwise the palate will become vitiated, especially when continuous tasting has to be done. I believe when this is remembered, and a little fresh fruit taken between the different batches of tea to clean the palate, little harm can result, even to those who are tasting large quantities of tea daily. The liquor should be a rich brown, neither muddy nor light, and if, as it cools, it creams down to a rich chocolate colour, we may be fairly sure it is good tea. For "creaming down" ordinary milk is the best to use. If

the tea has been soured in the curing this will show in the milk.

Every grocer owes it to himself and his blend to see that his customers have no excuse for making their tea badly and so spoiling the fruits of his labours. By way of instructions—which may be printed in the price-list or separately as advertising matter—the following are recommended:—

*Hints for the
Tea-user.*

Hints to Tea-makers

1. To retain the flavour of tea keep it in a can or jar free from moisture and tightly closed by the lid.
2. In making tea use only an earthenware or china teapot, small, dry, and thoroughly clean.
3. Heat your teapot—scald it with hot water before using.
4. The teapot being hot and empty, put into it the quantity of tea required—a tea-spoonful for every cup.
5. Make the tea in the room where it is served.
6. Use freshly-drawn water, boiled as quickly as possible—*quite* boiled but not overboiled.
7. Pour the boiling water on the tea, and let it stand for three to five minutes, the lid of the teapot being closed.

Never boil the tea when made, and be careful it does not steep too long. For more than five cups have two teapots.

4. COFFEE

“Mocha” is supposed by most people to be a typical coffee, and it is associated in our minds with Arabia as a typical coffee-growing country. But “Mocha” is now seldom seen, and probably Arabia is not the original home of the coffee-plant, for it has never been found there in its wild state. On the other hand, the plant is found growing in many places throughout tropical Africa. It is therefore thought most likely that coffee reached Arabia from Abyssinia, having been taken by the Ethiopians to Yemen. The Abyssinians themselves (with the exception of the Mohammedans among them) at the present day use very little coffee; nearly all that gathered in the various

*The Origin
of Coffee.*

provinces finds its way to the coast by way of Djiboutil and (especially) Zeila, whence it is marketed as "Mocha" coffee.

It is argued with some seriousness that coffee could not have been known in Arabia at the time of Mahomet, because if so it would certainly have been included by the Prophet as one of the attractions of his celebrated Paradise. However that may be, it is accepted that at least in the fifteenth century the Arabians cultivated the plant, and that the use of coffee gradually spread from Aden to Mecca, Medina, Cairo, Syria, Greece, and Turkey during the sixteenth century. About a hundred years later (in 1652) an English merchant named Edwards, returning from the Levant, brought with him a Greek who knew how to prepare coffee for use, and thus introduced the beverage to London. On the Continent it also became known about the same time.

The coffee shrub or tree belongs to the botanical genus *Coffea*, one of the natural order of plants known as the Rubiaceæ, which includes also Cinchona, Ipecacuanha, and other useful members. This genus *Coffea* is divided by botanists into a large number of species. Some authorities mention about sixty species, others considerably fewer—eight or ten—and class the remainder as varieties only. Fræhner, a botanist of repute on the Continent, describes about thirty different coffee-plants as being the principal species. But for all practical purposes it is sufficient to distinguish chiefly two kinds only: *Coffea arabica*, the Arabian coffee, and *Coffea liberica*, or Liberian coffee. The former plant, or slight variations of it, supplies the greater part of the commercial article. *Coffea arabica* is a shrub or small tree, which may grow to a height of 15 to 25 feet, and which, especially when covered with fruit, is not unlike a cherry-tree in general appearance. The blossom is a small white flower, resembling in form and odour the flowers of the jessamine. These coffee-flowers are collected in groups of three to seven in the axils of the leaves. The fruit, or "cherry" as it is termed, is dark-green when young, changing afterwards to a yellow or yellowish-red, and eventually to a deep crimson. There are, however, differences between the several varieties. In one plant (*C. leucocarpa*) the mature fruit is white. The external portion of the "cherry" comprises an outer skin, beneath which is a glutinous pulp, followed again by

a rather thick and tough membrane or "parchment". This membrane surrounds the "beans", of which there are usually two in each cherry, although sometimes there may be only one. The beans themselves are closely enveloped by a delicate, semi-transparent integument—the "silverskin", of which portions are often found in ordinary commercial coffee, entangled in the longitudinal furrow on the flat side of the bean. *Coffea arabica*, or varieties of it, is cultivated chiefly in Brazil, Java, Ceylon, India, Central America, the West Indies, Arabia, Abyssinia, Natal, and Australasia. It grows best on elevated ground, its range in this respect being from about 1000 feet to 4000 feet above sea-level. A moist climate, and a temperature of 60° to 80° F. in the shade, are the most favourable conditions of cultivation. In Brazil—which now furnishes considerably more than half of the world's production of coffee—the plant most widely cultivated is the variety called *Café nacional*. It is a special variety of the Arabian coffee, more robust and less prone to disease than the ordinary plant. About three-fourths of the Brazil coffee-plantations grow the "nacional", the remainder being devoted to "Bourbon" coffee, and to a variety termed *Botocatu* or *Amarella*. The Liberian coffee-plant (*Coffea liberica*) is generally a much larger and more vigorous plant than the Arabian. It is a small tree growing to a height of 30 to 35 feet, and flourishing upon low ground as well as upon hillsides. The leaves and berries are more than twice the size of those borne by *C. arabica*. Also, the berries are produced in great profusion; and they do not, when ripe, fall from the tree as do those of the Arabian plant. The product, however, is of a coarser flavour than is found in ordinary Arabian coffee, though it is said to be much improved under cultivation, and by judicious crossing with *Coffea arabica*. The growing of Liberian coffee for commerce has been introduced on a somewhat extensive scale into Ceylon, Dominica, and other places.

Mention may be made here of a coffee-plant indigenous to Sierra Leone, the exceptional qualities of which would appear to promise that before long the product will rank as of the highest class, and which is said to have already fetched the price of the best Mochas in France. It is called "Highland Coffee", and the tree belongs to the species *Coffea stenophylla*. Specimens

Cherries and
Beans.

of the plant were sent to Kew Gardens in 1894: these flowered in September 1895, and seeds have since been sent to various British colonies to see if the plant could be acclimatized. At present it is not certain whether the cultivation will be a commercial success. In Ceylon the results were not very satisfactory; but in Jamaica, Dominica, and Trinidad the plants appear, so far, to flourish very well and to remain free from disease.

Coffee is raised either from the seed, or else from seedling plants which are collected by natives in the neighbouring forests, and on disused estates, or which grow, self-sown, on the plantation itself. In Arabia most of the plantations are supplied in the latter way. To some extent the same is the case in the Rio and Santos districts of Brazil, and in the French Congo. These seedlings result from the seed pillaged by monkeys and birds: it is dropped in the forests and there takes root. When grown from seed on the plantation, the seed is sometimes simply sown direct, but usually it is first germinated either in pots, or in seed-beds and nurseries. A bushel of seed will give from 20,000 to 30,000 plants. The resulting seedlings, generally of about two seasons' growth, are then transplanted to the permanent grounds. They are planted at distances apart varying from about 6 feet in Ceylon to 12 feet in Arabia. In the latter country the finest and most abundant coffee is produced by trees ranging from 6 to 10 feet in height; the larger trees of 12 to 15 feet give small yield and less valuable berries. Liberian coffee-trees, being generally larger than the Arabian variety, are naturally placed farther apart, 13 feet being the average distance for these plants in Jamaica and Ceylon. A good deal of attention in the way of weeding, manuring, and pruning is required by coffee-plants. When the young trees are somewhat advanced, they are "topped" to stimulate lateral growth, and also to keep the height down for facility of gathering. In several districts the fruit-bearing trees do not exceed 4 or 5 feet in height. As the season advances, the clusters of snow-white blossoms gradually yield place to the yellow berries of the fruit. These, as they mature, eventually deepen in colour to red or purple-crimson, and are then ready for plucking.

The time of gathering varies with the country. In the Arabian province of Ramed it begins towards the end of August;

in Venezuela it is about the middle of October; in Brazil the season lasts from May to September, and in Ceylon and Java from April to October. As a rule two or three pickings are required. Of these the second is usually the chief harvest, and the others subsidiary. The Liberian coffee ripens almost all the year round. In Costa Rica the trees blossom in April and the cherry ripens six months later, whereupon picking begins.

In Brazil harvesting is done in two ways—the *da terra* and *da lençol*; the former being the more usual. In this method the work-people go over the plantation and strip the young branches from base to tip by drawing the hands down them. Leaves and fruits thus fall together on the ground, which has previously been cleared from debris. The strippings are then raked up and the fruit roughly separated from the twigs and larger leaves. In the Santos district the *lençol* method of gathering is preferred. A cloth is spread on the ground between two rows of coffee-trees, the overhanging branches of which are then stripped of their leaves and berries. In Arabia the same method is adopted, but the trees are shaken, not stripped, so that only the ripe berries fall on to the cloths. Where the Liberian coffee is grown the gathering is perforce done by actual plucking, since the fruit does not fall when ripe; moreover, the trees being tall, ladders are necessary for reaching the berries.

The method most used for preparing the bean for market is the “wet” method, or West Indian process. It involves separating the pulp from the “cherry” as soon as the latter is picked; whereas in the older methods, as still employed in Arabia, the fruit is dried and the dessicated envelope afterwards removed by milling. The various stages of manufacture are:—

<i>Wet Method</i>	<i>Dry Method</i>
(1) Pulping. (2) Fermentation and Washing. (3) Drying. (4) Decortication and Polishing. (5) Sifting or “Sizing”.	(1) Drying. (2) Decortication and Polishing. (3) Sifting.

Only the Wet process (“Washed” Coffee) need be described. *Pulping* consists in removing the outer fleshy part of the cherry.

Harvesting
Methods.

The
Manufacture
of Coffee.

A number of machines have been invented for the purpose, the two chief kinds being known as "disc" pulpers and "cylinder" pulpers. The action of the machines is essentially like that of a magnified grater rubbing the berries against a fixed surface, the latter being set at such a distance from the teeth of the grater as to allow of the cherries being bruised without the beans being damaged. In this way the fleshy portion of the berries is removed, and the berries—still covered with their tough "parchment"—separated from the pulp. The *Fermentation* is intended to remove saccharine matter from the beans, which otherwise could not be properly dried. It may be either "dry" fermentation, in which case the coffee with its "parchment" is allowed to remain in a perforated tank during the operation; or "wet" fermentation, when the tank is filled with water. In either case the coffee remains until a slight fermentation occurs, which may require anything from 12 to 50 hours, according to the weather. After this the liberated saccharine matter and its products are washed away by treatment with water in the tanks. The berries

**Drying
the Berries.**

are then drained ready for drying. The *Drying* is an important operation, because badly-dried coffee is liable to alter rapidly, whereby its commercial value is affected. The berries after draining are either dried in rotating machines by means of warm air, or else are spread out on terraces (*patios*) exposed to the sun, and are constantly turned over by rakes or by the feet of the coolies. The drying must be regular, and not so rapid as to crack the parchment before the bean is dry. Several days' sun-drying are required, the resulting dry and brittle coffee being known as "parchment coffee" (or simply as "parchment"). In this condition it is generally sent to the ports, and its further treatment is left to the shippers. To remove the parchment and silverskin from the berries they are further exposed to the sun for some time, and then passed through a "peeler and polisher" or "huller". The coffee when freshly-

**Hulling
and Sifting.**

hulled is very light-coloured; but it rapidly becomes of a permanent horn-green or yellowish-green colour, unless it should be exposed to the damp, when it assumes a dingy or mottled-gray tint, and is then liable to be classed as "country-damaged". The mixture of peeled coffee and skins is next winnowed to separate the latter, and the berries are sifted ac-

cording to their size and shape by means of a mechanical sieve or "separator". After being thus "sized" into "bold", "medium", "pea-berry", and "broken"—which is chiefly necessary in order to have the berries of uniform magnitude for subsequent roasting—the coffee is packed in casks or bags for shipment.

A good quantity of coffee in the parchment is now received by all the chief European markets, the importers doing their own hulling, &c., in special husking mills. Such coffee preserves its colour better, and is placed more quickly on the market. Coffee thus hulled in London is called "London cleaned".

General Characters of Commercial Coffees.—The commercial value of coffee, like that of tea, does not depend upon its chemical constituents, except perhaps indirectly to a small extent. The form, size, colour, odour, flavour, age, and uniformity of the beans are the chief factors which determine the value; together with the presence or absence of stones, pieces of stem, and other foreign matters. As an index of quality the country of origin is a good guide in a general sort of way, but it cannot be entirely relied upon. *Shape* varies in the same sample, and consequently is not by itself a sure criterion of the source. There are, however, at least three typical forms:—Small and rounded (Mocha short berry); medium-sized, elongated, and pointed (pointed Bourbon); and large, flattened berries (Martinique). *Colour* depends upon local peculiarities of growth and preparation. Speaking broadly, the coffees produced in the Western Hemisphere are of a greenish tinge, those raised in the Eastern are more or less inclined to yellow. Examples of the former are Cape Haytien, Guadeloupe, Gonaives, Martinique, and Porto Rico; and of the latter, Java, Manilla, Wynaad, and some kinds of Mysore. But coffees from the same region often differ greatly in colour. *Odour* is a fairly distinctive test, but requires much practice in its application. The smell of green Mocha suggests that of tea; Jamaica is agreeable; Brazil, strong and varying in Rio and Santos; Java and Sumatra, sharp; and Manilla, very pronounced. *Flavour* is also a good guide as to the origin of a coffee in some cases. Thus Sumatra coffee is slightly bitter; Mocha coffee has a highly distinctive flavour, that of Martinique is very agreeable, and Guadeloupe and Porto Rico products are less so. Brazil coffee has a peculiar flavour, readily

Characters
of Coffees.

recognized by experts. As regards *Uniformity*, Brazil, Java, and Martinique are examples of coffees which as a rule have the beans of fairly regular size. St. Domingo and Mocha, on the other hand, are typically irregular. Ceylon, East Indian, Brazilian, Martinique, and Java coffees are generally well-prepared and clean; of the Brazil products, however, Santos coffee, as a rule, is not so well cleaned as that from Rio. St. Domingo coffee is often dirty. Comparing broadly the principal coffees, it may be said that genuine Mocha has the greatest reputation, but is now little known, and in quality it is certainly run very close by one or two other kinds. In fact, some authorities consider that in unroasted coffees there is not much to choose between yellow Mocha, finest Jamaica Blue Mountain, East Indian Plantation Mysore, and the best Costa Rica. For weight and boldness of bean the East Indian Naidoobatum, Neilgherry, and Plantation Ceylon may be classed next. Washed Rio, Costa Rica, Guatemala, and other Central American sorts are favourites, as being generally of good colour and well prepared. Costa Rica coffee has made wonderful progress of late years, and is now pronounced amongst the best of all seen in England.

The
Various Kinds
of Coffee.

The various kinds of coffee have been grouped as follows:—

Central American.—Costa Rica, Guatemala; other Central American, including Honduras, Mexican, Nicaraguan, Colombian, &c.

South American.—Brazil, including Rio de Janeiro and Santos; Venezuela and Ecuador.

East Indian.—Ceylon, Java; other East Indian, comprising Mysore, Naidoobatum, Neilgherry, and Coorg.

West Indian.—Jamaica; St. Domingo, including Gonaives, Hayti, Jacmel, Jeremie, and Port-au-Prince; Porto Rico, Cuba, New Granada.

African.—Abyssinian, Nyassaland, &c.

Arabian.—Mocha.

Ceylon.—Of this there are two chief sorts, Plantation and Native. *Ceylon Plantation* is a fair-sized, pale-greenish or bluish berry. Its infusion has a full but smooth flavour with a fair amount of body, and very clean. The article arrives in London about November or December; but the imports of Ceylon coffee are now very small compared with what they were thirty years ago, the culture having been supplanted by that of tea.

Java is a fine coffee, giving a strong and clean liquor. The berries are large, of oblong shape, and vary in colour from whitish to pale-yellow, or greenish.

Mysore is a good-sized berry, the best kinds being plump and heavy. Colour bluish-gray or greenish, with more or less of a silvery covering. It yields a fine, strong, and clean liquor.

Naidoobatum is an excellent coffee, for the most part coaty and bold.

Neilgherry is a delicate greenish berry, giving a good flavoury infusion.

Coorg is a good and flavoury coffee, but rather thin.

Jamaica is a smooth, medium-sized bean for the most part, rather oblong, with an agreeable odour and excellent flavour. Colour ranges from gray and greenish to bluish-green or blue; some kinds are rather large yellow berries tinged with green. In fact, Jamaica coffee is very varied in quality. Inferior sorts are of mixed colours, often with pale flat berries and mixed with "blacks". The lighter kinds give a thin liquor, but clean, and generally possessing a delicate flavour.

St. Domingo, &c., much resembles the commoner, pale-coloured Jamaica; but gives a rougher infusion.

Porto Rico is a large, coloury berry. *Cuba* is rather small, sometimes with red streaks, and giving a strong liquor; *New Granada* is also a small bean, gray, greenish, or approaching silvery in colour, and yielding a fine strong infusion.

Costa Rica is a bluish-green berry, large and bold, and yielding a strong, useful liquor. Formerly somewhat coarse, the best Costa Rica is now one of the very finest coffees grown.

Guatemala is mostly of pale colour and mildish infusion.

Other Central American sorts more or less resemble Costa Rica. The beans are large or medium-sized, and more or less oval in shape; but the colour varies a great deal.

Brazilian coffee comes from two celebrated districts, Rio de Janeiro and Santos. The Rio coffee is generally the cleaner, but the Santos bean is usually larger, and of a better colour and aroma. Good Santos coffee is of a pale-yellowish colour, immature beans being more or less green. The Brazil sorts comprise both "washed" and "unwashed" coffees; the latter, however, are objected to by the home trade on account of their peculiar

flavour, and are mostly exported. Washed Rio, if of a blue shade, is a good coffee; and in fact some of the varieties of Brazilian are good enough to be passed off as the Mocha or Java products. Brazil "pea-berry", a smaller and more rounded bean than the ordinary coffee, is sifted from the larger and flatter berries and often marketed as Mocha, to which it bears much resemblance.

Abyssinian is exported from the Red Sea ports, and placed on the market as "Mocha", to which it is very similar.

Mocha coffee is of two varieties, "long berry" and "short berry". The former are grayish-yellow in colour, and give a rich mellow liquor. Mocha short berry is small, roundish, and of a pale, greenish-yellow tint; it gives an infusion similar to that of the long berry, but cleaner and more delicate. Beans of a brown colour are frequent in the Mocha coffees; but gray or whitish berries are looked upon as a sign of adulteration with inferior West Indian products.

By way of summing up an expert writes:—

Nowadays the best value is undoubtedly shown in Costa Rica, and this growth mixed with a little East India or Mysore forms the best all-round blend for general purposes. For lower prices, Central American sorts, New Granada and Columbian are suitable. Mocha at best is a fancy variety, and a small percentage may be used in a blend if it be desired to produce a distinctive flavour. Costa Rica comes over here in two states—(1) In the parchment; (2) with the parchment removed. The first, when sold, is known as "London cleaned", the latter as "foreign cleaned". The former has a brighter and more blue appearance, but this soon goes off. The latter is grayer, and does not fade so quickly; as a rule, too, it returns better when roasted. Mysore and East Indian growths, instead of showing the clear surface of the Costa Rica berries, should be coated with a silvery skin. Central American sorts more resemble the Costa Rica in the character of the berries.

Coffee is composed of the following ingredients:—An alkaloid called "caffeine"; sugar; caffeic acid; fat and oil; albumen and other nitrogenous bodies; cellulose, and mineral matter; with a certain quantity of moisture. A little dextrin and more or less colouring matter are also present. **Caffeine** is the substance to which the chief physiological effects of coffee are due—namely, the stimulant and refreshing action. It is identical with the theine of tea. About 1.2 per cent of caffeine was found as the average quantity present in the analysis of fourteen different kinds of coffee, representing most of the

The
Chemistry
of Coffee.

chief commercial varieties. Although this is only about one-third of the amount of theine found in the leaf of tea, yet, on account of the greater weight of coffee used, a cup of coffee as ordinarily prepared contains quite as much alkaloid as a cup of tea does. Caffeine, when separated from coffee and purified, is a mass of long, white, silky, needle-like crystals. **Sugar** is contained in the raw berries to the extent of about 9 or 10 per cent. During roasting, however, nearly all this sugar becomes converted into caramel. It is not the same substance as ordinary cane or beet sugar. **Caffeic Acid** is a yellowish solid, occurring in coffee to the extent of from 3 to 5 per cent. When heated it emits the peculiar odour of coffee, and from this it is thought that this acid plays an important part in developing the flavour found in the roasted beans. **Fat and Oil** exist in coffee to the extent of about 12 per cent or more. They become altered to some extent in the process of roasting, and about 1 per cent is lost in the operation, or more if the coffee is over-roasted. The chief aromatic principle of roasted coffee is a substance termed "**cafféone**". It is an oil which has the characteristic aroma of coffee, and is produced, during the roasting, by the action of the heat upon the fat, oil, and other constituents of the raw coffee. A portion of the nitrogenous matter of coffee is present in a soluble or readily-digestible form; this constitutes the *albumen* or *legumin*. The albumen imparts a certain amount of nutritive value to coffee, over and above the purely stimulant effect of the alkaloid common to both tea and coffee. **Cellulose** is the substance to which coffee berries owe their hard and horny character. It constitutes about one-third to one-half of the whole berry. The **mineral matter** (ash) of coffee consists largely of carbonate and phosphate of potash, with small quantities of lime and magnesia. The **moisture** (water) in ordinary unroasted coffee generally ranges from about 6 to 10 per cent. In the roasted berries it is about 1 per cent or less, as a rule. The total loss of weight which a medium-roasted coffee suffers in roasting is about 15 to 20 per cent.

Coffee
Analyses.

The following are analyses of typical samples of coffee, both before and after roasting. They will serve to show the general composition of the article, and also the extent of the changes which roasting produces in the various constituents:—

ANALYSES OF COFFEE

	Mocha.		East Indian.	
	Raw.	Roasted.	Raw.	Roasted.
	Per Cent.	Per Cent.	Per Cent.	Per Cent.
Caffeine	1.1	0.8	1.1	1.0
Sugar	9.6	0.4	8.9	0.4
Caffeic Acid	8.5	4.7	9.6	4.5
Fat and Oil	12.6	13.6	11.8	13.4
Albumen or Legumin	9.9	11.2	11.2	13.1
Alcohol extract, containing nitrogenous } and colouring matter ... }	6.9	14.1	4.3	12.7
Dextrin	0.9	1.2	0.8	1.4
Cellulose and insoluble colouring matter	38.0	48.6	38.6	47.4
Ash	3.7	4.6	4.0	4.9
Moisture	8.8	0.8	9.7	1.2
	100.0	100.0	100.0	100.0

A slight loss of caffeine during roasting is shown by the above figures. From other experiments which have been made, however, it appears that this loss is generally very small if the roasting is properly carried out. Besides the expulsion of water, the principal changes during roasting are shown by these analyses to be the almost complete elimination of the sugar and the diminution of the caffeic acid. The saccharine matter is converted into caramel by the heat, and about one-half of the caffeic acid is altered during the development of the aroma. These altered products go to increase the quantities shown opposite "colouring matter" in the analyses.

As regards the significance of the constituents of coffee from the dietetic point of view, it may be remarked that the ingredients of chief physiological importance are the alkaloid caffeine and the foodstuffs—namely, the saccharine matters, fat, and legumin or soluble albumen. It is in the presence of these last three nutritive substances, and in the practical absence of tannin, that coffee differs from tea as an article of diet.

The principal substances which at one time or other have been used for mixing with or adulterating coffee are:—(1) Roots, such as chicory, dandelion, mangold-wurzel, turnips, Adulterants of Coffee. parsnips, and carrots. (2) Seeds, such as beans, peas, date-stones, acorns, malt, rye, &c. (3) Miscellaneous articles, such

as figs, biscuits, locust beans, and burnt sugar. In addition to these forms of adulteration, factitious coffee-berries have been made by pressing a paste of flour, sugar, and water into moulds of the proper form, and slightly roasting the "berries" thus produced until sufficiently brown to mix with genuine berries.

Chicory is, of course, the usual ingredient employed for mixing with coffee. The sale of such a mixture is legal provided it is sold as such; nor is there any limit fixed for the amount of chicory which the mixture may contain. Moreover, "chicory" may legally consist of the roasted chicory root itself, or of a substitute such as an allied root, or other vegetable substance applicable to the uses of chicory.¹ It is therefore only when a mixture is sold as coffee that chicory is looked upon as an adulterant. Chicory is the root of the wild endive, a plant known to botany as *Cichorium Intybus*. In England it is cultivated chiefly in Yorkshire and in the eastern counties, but most of the supply is raised on the Continent; Northern France, Belgium, Holland, and Germany being the principal sources. The plant blossoms about August, and bears bright blue flowers. The roots are white and fleshy; after being dug up, they are washed, sliced, and kiln-dried; and finally roasted. In the raw state chicory contains about one-fourth of its weight of sugar; and although, as in the case of coffee, a great part of this sugar is converted into caramel or burnt sugar during roasting, there still remains a considerable quantity unaltered when the operation is finished:—

				Sugar—	
				In Raw Chicory.	In Roasted Chicory.
Foreign Chicory	...	...	...	23.8 per cent.	12.0 per cent.
English "	...	...	...	35.2 "	18.0 "
Guernsey "	...	...	...	30.5 "	16.0 "
Yorkshire "	...	...	...	32.1 "	9.9 "

The large quantity of caramel produced in chicory during roasting furnishes the means of applying a simple and convenient preliminary test for detecting the presence of chicory in coffee. When a few grains of coffee containing chicory are placed on the surface of water in a test-tube or wine-glass, each particle of chicory becomes surrounded by a

¹ But in such cases the chicory substitute must have a proper excise-duty label affixed on every package sold.

yellowish-brown cloud of colour, which rapidly diffuses itself in streaks through the water till the whole liquid acquires a brownish colour. Pure coffee under similar conditions gives no sensible colour to the water until after the lapse of about a quarter of an hour. Other sweet roots (parsnip, beet, turnip, &c.) when present will produce under like conditions the same effect as chicory, but not, as a rule, so strongly or so rapidly as the latter. The colour produced in all these cases is mainly due to the burnt sugar, which also imparts to the infusion the taste of caramel bitter that is one of the chief inducements to the use of chicory. The *quantity* of chicory which has been mixed with the coffee is determined usually by making a 10 per cent infusion of the mixture—say, one ounce in exactly half a pint of water, and then taking the specific gravity of this infusion. (The “specific gravity” means the weight of any definite volume of the infusion, divided by the weight of the same volume of pure water at the same temperature.) Chicory infusion is much denser or heavier than that from coffee. A bottle which, when full, holds 1024 grains weight of the chicory infusion, will only hold 1009 grains of the coffee liquor when filled with the latter infusion. In other words, if the sample is all chicory, the specific gravity of the infusion is 1024; if it is all coffee, the specific gravity is 1009; and if it is a mixture of the two, the specific gravity will be something between these two numbers. A mixture of half chicory and half coffee, for example, gives an infusion of specific gravity $1016\frac{1}{2}$ or thereabout.

If other roots, cereals, &c., are used as adulterants instead of chicory, their presence is first ascertained by means of the microscope, and then the amount can in many cases be determined from the specific gravity of the infusion, precisely as with chicory.

“**French Coffee**” consists in almost all cases of a mixture of coffee, chicory, and burnt sugar. The last substance has a clear bitter flavour, and this masks the earthy taste of the chicory, which when present in large proportions imparts to the “coffee” a full, earthy, and mawkish taste. Such mixtures must be preserved in tins, because when much chicory and caramel are present they readily absorb moisture if exposed to the air, and become clogged together.

The excise duty upon “other vegetable matter applicable to

the uses of chicory or coffee", which had previously been the same as on coffee and chicory, was repealed in 1882; and in its place a duty, to be secured by means of stamped labels, was levied upon all imitations of coffee and chicory. The regulations as regards the sale of these substitutes stipulates that the mixture is to be made up in packets containing $\frac{1}{4}$ lb. or any number of $\frac{1}{4}$ lbs., and the duty is one half-penny on every $\frac{1}{4}$ lb. The duty is to be paid by means of adhesive excise labels affixed to each packet. Ingredients of mixture to be specified on every packet. Penalty for selling, or keeping ready for sale, such mixtures without conforming to the foregoing conditions, £20 fine and forfeiture. Penalty for having in possession labels which have been previously used, £100. These regulations, it should be noted, have nothing to do with the sale of mixtures of coffee and chicory only, but only apply when the imitation articles are introduced into such mixtures.

Coffee and
Chicory
Substitutes.

A multitude of substances have been tried as substitutes for coffee, the most important comprising cereal grains (oats, barley, rice, corn, rye, maize), either alone or soaked in beer, rum, or brandy; chestnuts, beans, peas, haricots, buckwheat, almonds, arachis, &c. The employment of most of these substitutes has now, however, practically ceased. A "coffee" substitute of fair quality may be made from the sweet nuts or acorns of the Spanish oak-tree—a fruit which is eaten in Spain, Portugal, and Corsica. If these nuts cannot be obtained those from the ordinary oak are used, which are buried for a time to abolish the bitter taste that they possess. In order to obtain a cup of this coffee at the desired degree of concentration 15 grammes of sweet torrefied and ground nuts are necessary. Another coffee substitute is "gombo", which is found in the form of small, dry fruits. This is described as an agreeable preparation, superior to the inferior qualities of coffees.

"Gombo."

To obtain this result only well-selected seeds must be employed, and those which are quite ripe and which have been roasted with great care. The process which M. Rattier found to answer the purpose best consists in placing the seeds in a coffee-roaster and continuing to heat them as long as a crackling sound is heard. As soon as this ceases they should be spread out on a

marble slab, or upon any other object where they will become cooled as quickly as possible. They are then ground and passed through a filter; when reduced to a fine powder, and after having been sieved, they are mixed either with milk or sweetened water. By a procedure somewhat similar to that used when dough is required, a product is obtained bearing a resemblance to chocolate, which is agreeable to the palate, still preserving distinctly the special aroma which distinguishes the seed or nut. "Black coffee" is supplied by the *Cassia occidentalis* (a shrub belonging to the Leguminosæ family), growing in the warm regions of Asia, America, and Africa, and emitting a very disagreeable odour. According to M. Bélanger, black coffee figured very prominently at the Universal Exhibition of 1855 in a number of products from Guadeloupe, and in the notice sent to the exhibition with these products the following statement by Dr. Desbonne occurs:—"These nuts are collected and roasted, and, after having been reduced to powder, a very agreeable infusion can be prepared from them very similar to coffee". In the course of Dr. Desbonne's eulogy of this product he maintains that this infusion would answer admirably as a coffee substitute, being far preferable to coffee and chicory. Fig Coffee, prepared by the torrefaction of the ordinary fig, is largely made in Austria (the Tyrol), Germany, and elsewhere.

Coffee Essences and Extracts consist usually of an infusion of coffee and chicory, with more or less caramel; but they may, of course, be prepared from coffee alone. The infusion may be made either by digesting the ground coffee and chicory with boiling water, or by percolation with water; in either case it is evaporated to the proper consistency and mixed with the requisite quantity of caramel. Half as much chicory as coffee, and half as much caramel as chicory, are proportions which have been recommended for the ingredients of a good coffee extract. The essences and extracts lack the fine aroma of freshly-prepared coffee infusion, and are said to be frequently deficient in caffeine. Nevertheless they are a convenient form in which to have the beverage when required for ready use.

Coffee should be kept in a fairly dry, moderately cool place, not too draughty, and not in proximity to strong-smelling goods, since it is liable to absorb powerful odours and to deteriorate

thereby. While avoiding actual damp, the place should not be too dry or airy, since the evaporation of moisture causes the gradual loss of freshness and eventually of quality. Coffee improves by keeping if properly stored. After roasting and grinding, and where circumstances allow, it is best packed in air-tight canisters whilst still hot, and kept from exposure to the air as far as possible until used. See COFFEE ROASTING.

Coffee extracts should be corked air-tight and kept in a cool place.

The following are the average weights of coffee as dealt with on the wholesale market:—Jamaica, casks 6 to 8 cwts.; barrels and bags $1\frac{1}{2}$ to 2 cwts. Plantation Ceylon, casks 7 to 10 Coffee
Weights. cwts.; tierces 3 to 6 cwts.; barrels 2 to 4 cwts.; bags 1 to $1\frac{1}{2}$ cwt. Mocha, packages (frazils, bales, and half-bales) $1\frac{3}{4}$ cwt. Abyssinian, half-frazils $1\frac{1}{2}$ cwt. Liberian and Johore, bags $1\frac{1}{4}$ to $1\frac{1}{2}$ cwt. Other East India, Cannon's Mysore, Santawarry, Telli-cherry, Neilgherry, Ketergherry, Wynaad, Naidoobatum, Coorg, Travancore, Nelliampathy, Courtallum, Palney's, Shervaroy, Salem, Manilla, Singapore, &c., cases 2 to 3 cwts.; bags $1\frac{1}{4}$ to $1\frac{3}{4}$ cwt. Java, bags $1\frac{1}{4}$ cwt. Costa Rica, Guatemala, Honduras, New Granada, Macassar (pale), Maracaibo, Nicaragua, Santa Cruz, San Salvador, Savanilla, La Guayra, Capitania, Coban, Colombian, Curaçoa, Ecuador, Venezuelan, Vera Cruz, Vera Paz, &c., bags $1\frac{1}{4}$ to $1\frac{1}{2}$ cwt. African, 1 cwt. Brazil (Rio, Santos, and Bahia), $1\frac{1}{4}$ cwt. Porto Rico, Cuba, St. Domingo, &c., casks 6 to 8 cwts.; barrels and bags $1\frac{1}{2}$ to $1\frac{3}{4}$ cwt.

5. COFFEE ROASTING AND HANDLING

"I am certain", wrote an experienced coffee-merchant some few years ago, "that with care taken in the selection and blending, and above all with close attention to the roasting, we may yet make coffee take the front place in the beverages of this country." The occasion of this statement was a complaint that a very general practice had set in amongst coffee-roasters of under-roasting the berry; it being suggested that the retail distribution of the article in a half-cooked state was one

Careful
Handling
Required.

important reason for the decrease in the consumption of pure coffee. The under-roasting was traced in turn to "cutting" amongst roasters, some of the leading wholesale houses having commenced the practice of roasting for their customers at 2s. per cwt., instead of 2s. 6d. or 3s., which was formerly the charge!

Numerous reasons are, from time to time, given in explanation of the decadence of the consumption of coffee in the British Isles, but one really vital point is seldom touched upon. It is not sufficient for the grocer to buy a coffee which he considers suitable for his trade, if he does not take care that it is presented to his customer in the best possible condition. In other words, the handling of the article is, more often than not, carried out without the care which should undoubtedly be bestowed upon it. At the same time the whole system of handling is probably wrong in a great many cases. The practice with too many grocers is to buy poor coffees ready roasted, to deteriorate them still further by adding too much chicory, and finally to sell them quite stale to a public which is absolutely ignorant of the way to prepare coffee for drinking. Such a system as this is obviously the surest possible method for killing a coffee trade. If we wish to improve the trade a diametrically opposite plan must be followed.

Good quality coffee must be bought. It must be roasted by the grocer himself and sold as fresh as possible. The mixing with chicory must be left to the customers themselves, if a high-class trade is desired. And the customers must be instructed in the simple art of coffee-making, which is after all a perfectly simple art, and one which repays a little trouble a hundred-fold. If this more enlightened policy were generally followed, we see no reason why coffee should not take second place amongst the beverages of the country, even if it did not displace tea and take first place, as it does in the United States.

In this country the principal growths of coffee employed are Costa Rica, East Indian, Jamaica, Guatemala, New Granada, and Venezuelan; then Java, Mocha, and Brazilian. Thus
 Chief Sorts Handled. we may quote the list of one of the chief wholesale houses in the trade, the standard blends rising from cheapest to dearest:—(1) Costa Rica and Colombian; (2) Costa Rica; (3) Costa Rica and East Indian; (4) Costa Rica, Colombian, and

Neilgherry; (5) Costa Rica blend; (6) Mysore, Costa Rica, and New Granada; (7) Mysore and Costa Rica; (8) Plantation Ceylon, Mysore and Costa Rica; (9) Choice Plantation Ceylon, Mysore, Blue Mountain, Jamaica, and Mocha.

To learn how to buy his coffees, every beginner should try to get an hour with an expert in a coffee-dealer's sale-room. The qualities of individual coffees, like teas, can only be learned by actually examining them; by smelling, roast-
On Buying Coffee.
 ing, and grinding the berry, and by making and drinking the coffee. A range of samples trustworthy as to their identity ought not to be very difficult to procure, and we advise any assistant or inexperienced grocer to procure such samples and study and experiment upon them for himself.

On this point Mr. James H. Brindley, of Birmingham, writes:

"If he desires some guidance as to quality, he should note carefully and select such coffees as are even and of good colour in the raw, clean and light in the seam, and weighty by comparison with other coffees if he tests them in his hand, as he would a doubtful coin. He should cut the berry, and note that the structure should be as solid as possible, and of even colour. In tasting the roasted and ground sample, he should expect marked indications of that which, for want of a better word, we call acidity, but not the acidity which is akin to sourness, nor that which comes from a thin and underdone roast. If his sample combines this desirable quality with a considerable amount of fulness—which, however, should not be fruitiness—he cannot go far wrong in selecting it.

"A good rough-and-ready method of testing a ground sample which is suspected of containing chicory is to throw a small quantity of it into a basin or glass of cold water, and a similar quantity of that which he knows to be genuine into another receptacle of like kind. Chicory, being largely soluble, will discolour the water, while the genuine coffee will cause but little alteration except in boiling water."

The following is from an address by the same authority:—

"Choice coffee was not the sole product of any one country, nor even of either hemisphere. With the exception of Mocha, which certainly had a marked individuality, and some East Indias—notably Mysore, which sometimes, but not by any means always, had the Mysore flavour, the aristocracy of coffee knew no merely national limits. It would be impossible to find a finer coffee than the finest Costa Rica. Having secured their really fine coffee, they should get another to go with it in which there were great body and pleasant flavour, say Guatemala, Salvador, or East Indian. They should not pay too much for mere size. Often the second size was truly delectable, but not so often the third, for herein would be found a rather large proportion of immature and undesirable berries. They must not think a few 'lights' would not matter, or that otherwise the coffee was so cheap they could afford to spend a little time picking them out of the bulk. Very likely the picking out would be neglected, and it did not pay. Often a pea-berry coffee could be had

reasonably, and would prove a welcome addition to the blend. As a rule, it was better not to blend raw coffees. Unless they were of the same degree of hardness they would not roast well together. If they decided to use any Mocha it should be used very sparingly. It had a rather high and 'gamey' character, and those who liked it liked it very much; but, like the taste for olives, any affection for it had to be acquired. He advised them not to make a fetish of 'marks', but to decide what they could fairly give for their raw coffee, and not to tie their merchant down to any particular grade or mark. They should go in for quality, and learn to judge the raw sample. They should see that the middle seam was not gaping. A straight, tight seam was a great desideratum. After cutting the berry through, if it appeared a nice colour and was tight in the inside, it could hardly be an inferior coffee. Colour, too, was desirable, so long as it was not artificial colouring. A pale gray coffee might roast very well, but it could not give a high-class liquor. If they ground a bit of the roast sample and a similar bit of one they wanted to follow, and wrapped them in a fairly porous paper, the one that made most discoloration of the wrapper was almost sure to be the better. But taste, and compare!"

In buying chicory select a good heavy-weight article, uniform in colour and grain. Before making your choice carefully draw a tea-spoonful in a cup of boiling water. The liquor should be sweet and faintly pungent, with no disagreeable flavour, and having all the necessary body. In "French Coffee", as elsewhere mentioned, a large proportion of chicory is introduced. We have a list before us which quotes one line in French coffee as containing 65 per cent of chicory!

In the wholesale coffee trade several kinds of machines are used for roasting, some houses having very large and elaborate plant. The roaster most generally employed is an open pan with perforated bottom, which is made to revolve over jets of gas. The roasted berries are poured from this pan into a trough with a wire-work bottom, through which a blast of air is driven to cool them. From the cooler they are passed through hoppers into grinding-mills, on a lower floor. The ground coffee is then mixed with chicory, packed, and labelled. There are, of course, variations in different coffee-roasting houses of the process just summarized. In one of the latest and largest plants it is claimed that by the use of special machinery coffee can be cooled "from red heat to stone coldness in two minutes", thus avoiding the loss of fragrance and enabling the coffee to be quickly packed, and its precious qualities all the better preserved to it. Other methods of securing this latter desideratum are practised, however. An American plan is to use a mixture of egg and sugar for coating the hot coffee bean so as to glaze it, and prevent either

absorption or evaporation. Syrup is also used for the same purpose; and in a French method sugar is used during the roasting for the purpose of "caramelizing" the coffee, or coating the beans with a dark-brown varnish of burnt sugar. A "glaze" of equal parts of Irish moss, gelatine, and isinglass, boiled in water, strained, and mixed with sugar and eggs, is described as "excellent"; but "highly-purified petroleum oil" seems to be decidedly illegitimate as an addition to coffee. Lard and water are other ingredients sometimes introduced into the roaster. When coffee-beans are roasted in the homely dripping-pan (which must be perfectly clean), they are held over a brisk fire and stirred until sufficiently browned, and when the beans become a cinnamon-brown, and begin to crackle, a table-spoonful of fresh butter is introduced, stirring well at the same time, after which the pan is removed and the beans placed while hot in a can and covered closely until wanted. Some add the beaten whites of two eggs with the butter to such a pan of roasting coffee. The coffee has to be put into the roasting-cylinder before it becomes too hot; the heating must be gradual and uniform, and all the beans must get it alike; there must be no smoke allowed to contaminate the coffee; the beans must not be scorched; and the operation is completed just after the beans have swollen and begun to crackle, and have attained the right colour. The object is to cook the coffee without scorching it, to evaporate the acrid oil, to avoid contamination from the fire or other source of heat, and to develop and retain the valuable principles of the coffee, the chemistry of which we have explained in the previous chapter.

Glazing
Coffee.

Points in
Roasting.

Coffee-roasting, as may be readily understood, is a delicate art requiring considerable skill and experience if it is to be properly performed. Not everybody can roast coffee, and not every grocer need attempt it; yet there is a great deal to be said for the trial, and nowadays the cost of the necessary apparatus need not be an insuperable bar—in fact, we have seen that the domestic frying-pan serves for the operation, and it is undoubtedly used largely for that purpose in France, America, and other countries. The following hints on the subject of coffee-roasting are offered by one who has studied coffee for many years:—

The roasting of coffee cannot be properly carried out by rule-of-thumb methods. The operator should have an intelligent

understanding of degree of roasting required. Thus, our American cousins have their coffee done to a cinnamon colour, but they then granulate the berry in a crushing-mill, and their coffee as a beverage is invariably boiled in the making. This cinnamon shade is quite unsuitable to our English taste; yet grades from a nut-brown to a brown-black are quite correct, if governed by the character of the water in use in the locality.

The first roast of a new parcel should always be carefully tasted to ensure that the proper degree of roasting has been attained. Corrections for future guidance are thus obtainable. Once settled, a standard sample should be kept, and matters are simplified. This is necessary, as hardly any two parcels are identical in every particular.

In the roasting, common coffees should mostly be taken rather higher than fine.

Cooling is not, as a rule, accorded its due importance as an element of success in roasting. Common coffee should be cooled as rapidly as possible until stone-cold. This will in a great measure check, if not entirely prevent, "sweating". Sweating is, of course, the greasy or oily appearance always noticeable on over-roasted coffee. When it appears on certain berries only in a properly-graded roast, it is caused by improper cooling. Naturally when the coffee leaves the roaster it is at a very high temperature, and if allowed to lie in bulk the internal portions continue to heat, and thus are in a "sweaty" condition. Fine coffees should be dropped in temperature very rapidly to about 120 degrees Fah., or, say, to a slightly warm condition according to the "*feel*", and afterwards allowed to cool gradually. This undoubtedly makes the roast keep better when in the consumer's possession.

Small roasts, especially when hand cylinders are used, require the greatest possible care. This is because the berries come so frequently in direct contact with the metal of the cylinder, and it is therefore imperative that the coffee be kept moving continuously up to the very moment of turning out. It is always necessary to stop the roast a *shade or two under* that eventually required, as it will always run up a bit before the cooling begins. This applies to large as well as small roasts.

The operator must always endeavour to keep cool and collected—especially when things go wrong! A total disaster can often be averted by prompt action. Coolness, the essential attribute of a successful roaster, can be acquired by most assistants if they will make it a rule to concentrate their thoughts on the matter in hand. They must bear in mind they will never become experts without it.

The coffee, once roasted, should be immediately enclosed in closely-lidded canisters, and from that time onward should be as little exposed to the air as possible. Every second that coffee remains so exposed it is losing quality and flavour. It is, of course, when the coffee is in the ground state that the greatest damage is done, and it is done most speedily. Coffee when ground is naturally highly aromatic. But this feature should seldom be in evidence, as it stands to reason that when coffee is so circumstanced as to give out its scent, it is equally badly placed for the retention of its quality.

The attention of grocers' assistants is not, as a rule, directed to the peculiar perishableness of coffee in its roasted and ground form—perhaps because coffee forms but a small part of the trade, and hence is considered more or less unimportant. But the great success of certain firms in different parts of England, who have laid themselves out to push the coffee trade by the simple method of presenting the article in its most alluring garb—viz. perfect freshness combined with fine quality—must surely give one “pause to think”.

On this point of the results obtainable by special and personal attention to coffee on the part of the retail grocers, some very interesting letters have from time to time appeared in *The Grocer*.

Is it
Worth While
to Roast?

A Yorkshire grocer wrote:—“A year ago I commenced roasting coffee myself, on the advice of a friend (who is an expert in the art), without any knowledge of the subject whatever. I purchased a small roaster, also an attractive counter-mill, which turned out a good advertisement in the shop. My friend gave me the first lesson, pointing out the meanwhile what to do and what not to do. After this I was left to myself, and may say I have been successful, never having spoiled any coffee, nor had a single complaint. My trade in this article has increased three

to four times, and I have had many words of praise from customers who had been induced to give coffee a trial when freshly roasted and ground. I attribute this to giving best possible value, as I have never advertised. I commenced with a good Costa Rica alone, afterwards adding one-part Jamaica, one-part East India in every 5 lbs. A tyro must see that he gets a good supply of gas for his roaster, as this is important, but his best plan will be to get someone experienced to put him in the way, if possible."

Another grocer, in business in one of the suburbs of Manchester (and since then in Manchester itself and elsewhere), wrote in the following terms:—"A question was put to me a short time ago by a wholesale dealer in coffee: 'Do you think you have sold more coffee since you began to roast your own, because all my customers say their trade in coffee is dying out?' To this I was pleased to be able to say: 'My coffee trade has increased more than threefold since I began to roast my own coffee'; and I feel sure that if grocers would adopt this plan (especially small suburban grocers) they would find it both an increasing and profitable trade. Speaking from experience, I can testify that, besides selling three times the quantity, I have nearly double the profit I had when buying ready-roasted, and the increased sales show that the quality pleases better. Further, as an encouragement to other grocers to do likewise, I may say that from a careful calculation I made during the first year I found that the increased profits alone had fully paid for the cost of the roasting apparatus. In these days of stores' competition it is needful that we should throw no chances away, and I believe many are throwing a good one away in not paying more attention to the coffee trade. It has astonished me to find how many store-prejudiced ladies have given in to the coffee being better than what they were using, and many of my best customers have been obtained through some casual purchase made when they were running short, and had not the time to get it from the stores. It also has some little effect on the tea trade, for some ladies who would look upon us as being demented if we happened to mention that we keep a good article in tea, and who would tell you loftily that they get a chest at once from the London stores (by the way, ladies always talk about a chest of tea if they have had a 15- or 16-lb. cad), will

sometimes, after finding they have been well served with coffee, try the tea; and, if not too prejudiced, you are sure of a customer. But it matters not whether they are prejudiced or not; if you can once introduce on their table an infusion of fresh-roasted coffee, it tells its own tale in unmistakable terms, and the cry is, Where did you get that coffee? You will please note that I am in no way interested in coffee-roasters beyond the fact of having benefited by the use of one, and I do not know whether I have the best kind of roaster or no; but I feel sure that any small or medium grocer would find it greatly to his advantage to do his own roasting. The fragrant smell appeals to the whole neighbourhood, and makes a good advertisement, and often induces passers-by to make a purchase who otherwise would never think of entering the shop."

The same gentleman, in a subsequent letter, said:—"I had for fifteen years been in the habit of paying a long price for ready-roasted coffee. Occasionally I bought raw, and sent it to town to roast; but, as every suburban grocer knows to his cost, this is expensive. There is carriage both ways, and coffee-roasters usually charge more in proportion for small quantities (the same remark applies to carriers). Another plan I tried was to leave the raw coffee in the hands of the wholesale dealer, and have it roasted and sent in as required. But, without making any imputations, I may say that none of these plans proved satisfactory. I made no headway, and considering the price I paid for the coffee, it was discouraging to find that I usually came in for more blame than praise. A peculiar incident was the means of changing all this. Happening to call on a friend who had apartments in a house tenanted by a French family, I was asked to take a cup of coffee, and while drinking it my friend said: 'How do you like the coffee?' I liked it very much, and replied to that effect. He said: 'Well, that coffee is good, not because the quality is particularly fine, but because it has just been roasted on a fire-shovel over the fire'. This set me thinking, and I determined to have a roaster of my own. I visited an exhibition, and saw a gas coffee-roaster in use, but on too large a scale for my trade. Eventually I had one made to suit a 14-lb. roast, and nothing I have purchased since I began to trade on my own account has given me more pleasure; for, even

Fire-shovel
Roasting.

apart from the profit attached to it, there is the satisfaction of knowing one's customers are being well served. I did not forget the remark of my friend (I may say in passing he was a wholesale dealer in coffee), who attributed the excellence of the coffee as much to the roast as to the quality of the berry; so when I began to roast my own, I found I could please much better, and save in cost 20s. in cwt. on an average besides. Mind, I do not advocate the use of a common quality, but I have certainly found a No. 2-sized berry often give an A1 liquor. I met with discouraging remarks about the difficulty of roasting; but, fortified by the recollection of drinking good coffee roasted on a fire-shovel, I persevered and carried out my intentions.

"Burnishing and improving coffee is all very well in its way, and may help a wholesale man to sell to his own advantage; but it is not necessary; it is only on a par with the idea of buying tea for leaf instead of liquor. With regard to over-roasting, I may say that I have had very little trouble on that score. Providing the same weight of coffee is habitually roasted, you may with a gas coffee-roaster tell to a few minutes when it will be ready; and the only time I can remember having a spoilt roast was when I had a pound sample sent me. This, through forgetfulness, was burnt to a cinder. Again, I see it remarked that, 'roasting in large quantities is better than in small quantities'. As I cannot roast large quantities, I cannot say from my own experience what truth there may be in this. All I can say is, I don't believe it. I know this, that the small quantities I roast please much better than any I ever had when purchasing out of large roasts; but as regards appearance, I agree at once. If coffee were an article to be put in a glass case and used as an ornament, I should have to give up roasting; but, fortunately for me, it has to be ground and drunk, and, as I said in my first letter, once tried it tells its own tale. I will give an incident that occurred to me which bears forcibly on this phase of the question. Some time ago I was offered a coffee which, both in appearance and liquor, was highly satisfactory; but what particularly took my fancy was the handsome roast, and on this occasion I bought principally for appearance. The result was anything but pleasing, and, thinking a mistake had been made, I sent up a sample to London, and requested an explanation.

The firm behaved most handsomely—offered to make all right if a mistake had been made, and suggested to me that the coffee was a little under-roasted, which might account for the disparity in appearance, &c.; and in due course their representative called on me, examined the bags, found all the marks right, and then explained that the sample he had sold was out of a bulk roast, as they had found the bulk roasts were much better in appearance than the sample roast, perhaps owing to its being burnished in the bulk. However, he finished up his explanation with words to the following effect:—‘We all agreed in the office that we had never seen so ugly a roast, but we also agreed that if you had got the wrong coffee, we had sent you a better in mistake, for we never made it so good in liquor before’. So much for appearance in coffee! The fact is, coffee is being killed with too much scientific manipulation. I sell more coffee in the berry than I do ground, and discourage the use of chicory all I can; and what little I sell in a mixed state is usually mixed immediately after roasting, and before the coffee is cooled.”

The value of such practical testimony as the above to the retail grocer, who in a vast number of instances is placed in precisely similar circumstances, cannot easily be over-estimated. We can vouch for it that the “Suburban Grocer” quoted is a reliable witness—in fact he held for some years the honourable position of president of the Manchester Grocers’ Association.

In regard to handling coffee the following points are emphasized by an expert:—

- (a) Expose to the air as little as possible.
- (b) Induce your customers to do the same.
- (c) Keep your stock fresh.
- (d) If you sell it ground, sell it freshly ground.
- (e) Never allow it to come in contact with other goods.
- (f) Never grind anything but coffee in your coffee-mill.

Jealously guard your stock from the air, and from contamination by absorbing the odour of fruit, vegetables, &c. Grind it only as you sell it, and to ensure its reaching your customer in good condition parcel it in parchment or tinfoil bags. These cost a little more than the ordinary paper

Educate your
Customers.

packages, but the outlay will amply be repaid by increased sales. The same diligent care should be taken in handling the cheapest as the highest grades sold. The ideal cup is made from freshly-roasted and recently-ground coffee. Impress this on your customers, and induce them, if possible, to grind their own coffee, just as they want it for each meal. Small mills of good and lasting quality can be retailed; keep a dozen or so in stock, and press the sale of them. In countries where the sale of coffee is greatest *per capita*, it is ground by the customer.

How often do customers say: "We are fond of coffee, but it is so troublesome to prepare"! A grocer or assistant can remove this objection with the sincerity of conviction if he tries for himself.

Given a fine coffee, no better method of preparation can be found than the simplest:—Obtain an earthenware jug with a good deeply-flanged lid or cover. Warm the jug, having previously dried it; place the coffee at the bottom, and immediately the water quite boils, pour on the required quantity. Stir thoroughly, and place the jug in a warm place to settle the grounds. After five to seven minutes remove the scum, and if it is then steadily poured out the liquor will be perfectly clear very nearly to the bottom. Warm milk is a great improvement.

Where customers like chicory, the infusion strained and re-boiled with the milk is much improved, as the reboiling to a great extent removes the bitter flavour of the chicory.

"After-dinner" black coffee should be made from the pure article. For a breakfast beverage the addition of a small proportion of chicory is in some cases an advantage. The reason is that while coffee itself is astringent, chicory is a laxative, being a member of the same family as the liver medicine taraxacum.

A Brazilian apparatus for making coffee is thus described. The coffee is placed in the upper part of the machine on a wire gauze; the water is placed in a lower chamber, which communicates with the upper one by means of a long projecting tube. A spirit-lamp is provided to boil the water. When the water boils it travels up a central tube and falls as a spray on the coffee, and descends to the lower chamber. When finished, the coffee is in the chamber below, ready for pouring out, while the grounds remain above. The geyser-like action is said to produce good results, but we have not tested the machine.

It is a good plan to circulate among your customers simple instructions in print regarding coffee-making. Here is a specimen of a price-list fly-sheet:—

HOW TO MAKE GOOD COFFEE

In the first place buy ———'S COFFEE. This is a guarantee that the **Quality** is **Good**.

To each pint of water use 1 to 1½ oz. of **Pure** coffee. Put the coffee into a jug that has been scalded out. Pour the water upon the coffee when just boiling. **Stir up thoroughly**, and let it stand five minutes. Remove any scum with a spoon, and pour out carefully, or, if preferred, through a flannel bag. Metal should not be used. Add sugar and cream to taste. If cream is not available, **boiled milk** is a good substitute.

*Cut these directions out and fix them in a prominent place in the kitchen.
Particulars of directions are frequently forgotten.*

6. COCOA AND CHOCOLATE

Cocoa is prepared from the seeds of the plant *Theobroma Cacao* and kindred species, belonging to a family of trees allied to the Limes. The terms "cocoa" and "chocolate" are both of Mexican origin; and *theobroma*, meaning "food of the gods", was the generic name given to the cocoa-tree by Linnæus, with whom chocolate was a favourite beverage.

Some ten or more varieties of the cocoa-tree are known, all of which are natives of tropical America. The finest seeds are produced by a species largely grown in the West Indian Islands, Guiana, Venezuela, and Brazil, and which is Varieties
of Cocoa. cultivated also in various parts of Central America, Asia, and Africa. Caracas cocoa is generally considered to be the best. Of the other kinds (Trinidad, Surinam, Grenada, &c.), that from Trinidad has perhaps the highest reputation. The cocoa-tree is ordinarily about 15 to 20 feet high; and its leaves, which grow chiefly at the top of the tree, average some 8 inches long and 3 broad. Fruit is borne all the year round, and the principal gathering seasons are in June and December.

The fruit is a smooth-rinded, fleshy pod, from 6 to 12 inches long and 3 inches in diameter, shaped something like a short thick

cucumber. The seeds, of which there may be as many as forty in a single pod, are embedded in the pulpy interior of the fruit. When the latter is gathered, the seeds are removed and placed in boxes or pits in the ground for a few days, during which time a certain fermentation occurs; they are then dried in the sun or artificially, the whole process resulting in an improved flavour being imparted to the beans. The full character and aroma are then developed by roasting the dried seeds, which latter are afterwards husked and broken in a machine. After the husk has been separated by winnowing and sifting, the remaining crushed fragments of the kernels constitute commercial "cocoa nibs". The beans can also be deprived of the husk without crushing, the "nibs" then being the whole kernel ("whole nibs").

Describing cacao (*i.e.* cocoa) cultivation as practised in Ecuador, Señor Gonzales Bazo, Secretary of the Guayaquil Chamber of Commerce, says the tree commences to bear in its sixth or seventh year, reaches maturity in the tenth year, and then produces on an average 1 lb. of dry cocoa of good quality.

The cacao-tree grows in Ecuador to a height of 20 or 30 feet; its leaves are evergreen and lanceolated in form; the base of the main trunk attains a thickness of 8 to 10 inches; the bark is hard and of greenish coffee colour. The blossom is very small, pinkish white, and waxlike in appearance. It grows directly out of the main trunk and branches. If it fructifies the petals fall off, and from the stamens, in the course of from fifty to seventy days, an oblong pod is developed. This pod is of golden colour, and contains some twenty to thirty-five grains of cacao, enveloped in a gummy liquid, which coagulates on exposure to air. The outer rind of this pod is dark or golden yellow in colour and very hard, a sharp instrument being necessary to cut it open. Its size varies, according to the kind of cacao, from 8 to 15 inches long by from 2 to 6 inches thick. The outer rind is marked by longitudinal furrows, more or less pronounced, which indicate the interior arrangement of the seeds. Both the outer rind and the gummy contents of the pod are porous, and blacken in colour as soon as picked, and in Ecuador are of use only to fertilize the soil upon which they are cast. The seed or bean of the cacao is about the size and shape of a large almond. It contains the active principles

Guayaquil
Cocoa
at Home.

of theobromine, albumen, phosphates, fatty matter, and water. When dry, it is vitreous in appearance, covered by a skin more or less delicate, which is easily removed, and which contains a distinct pellicle. The colour varies from dark coffee to violet, the latter indicating an inferior grade.

As soon as the pods begin to ripen, they are removed with pruning-knives, very sharp, and attached to the ends of long poles, which are lengthened by joints as often as required. As the twigs are very tough, the blow with this instrument must be strong and well-aimed, and the labourers must be experienced on account of the particular skill that is required and the fatigue that attends handling heavy poles sometimes 30 feet long, with the face continually upturned. The pods are heaped in piles by one set of labourers, while another cuts them open and extracts the contents. The drying is done on open platforms made of split bamboo and palms, where the cacao is exposed to the sun during three or four days, and in order that it may dry uniformly and well, labourers are employed to tread it out with bare feet. If not well dried the bean is apt to ferment, and if excessively dried it shrinks and finally turns black. When dried in this primitive fashion, considerable pulp yet adhering to the grain, the cacao is sacked and sent to Guayaquil to be sold in its natural state. Some merchants attempt to deceive the buyer by washing an inferior bean in achiote, which gives the skin the appearance of first-class cacao; but this practice is severely condemned by honest merchants, and is seldom followed; nor is reddish earth used here, as it is elsewhere, for the purpose of preserving the grain from decomposition and of increasing its weight. Reaching Guayaquil, the cacao is subjected to the cleaning process. Splinters, dirt, and defective beans are eliminated, and the adhering clusters of beans broken apart and dried several times before shipment. During this process the cacao loses 4 to 5 per cent in weight. The sacks for foreign shipment contain from 60 to 70 kilograms (132 to 154 lbs.) net. The largest portion of the crop is bought in advance by Guayaquil merchants engaged in this business, who loan considerable sums of money during the year for current expenses of cacao estates.

Cocoa in the form of "nibs" (as explained above) is the purest obtainable. But, for facility of cooking, the nibs require to be

Gathering
and
Marketing.

ground, and for greater digestibility the fat or "cacao butter", of which the beans contain nearly one-half their weight, requires to be partly removed or else diluted by mixing with other ingredients. Hence most of the cocoa now sold is manufactured cocoa. Of this there are three chief kinds: flake, rock, and prepared-powdered cocoas. *Flake* cocoa is usually made by grinding the entire roasted beans in a steel mill, and afterwards reducing it to a coarse paste, which is then dried. *Rock* cocoa is prepared from the nibs by grinding them in a warm mill, the fat being thus softened and a smooth plastic paste produced; a quantity of sugar, or of sugar and starch, is then added to the soft paste, and thoroughly incorporated with it. The other cocoa preparations, including the so-called "soluble cocoa", are either essentially similar to rock cocoa, but with different proportions of admixture, or else they consist of the ground nibs only, deprived of a portion of the fat.

From any of these kinds of cocoa a part of the "cocoa butter" may have been—and indeed usually is—removed. For this purpose the nibs are placed in bags and pressed in a hot press. The "butter" is a white or yellowish substance, either inodorous or with a faint smell of chocolate, solid or semi-solid at ordinary temperatures, and looking much like tallow. It is used for making confectionery and high-class toilet soaps, and also in pharmacy.

The starch used in cocoa manufacture is usually arrowroot, sago, corn-flour, *tous-les-mois* (canna), or potato. In the inferior brands such substances as cocoa-husks and ground cereals have been met with. The addition of starch tends to make the cocoa more miscible with hot water, and it is this miscibility, rather than any true *solubility*, that characterizes the "soluble" cocoas.

Pure cocoa contains about 4 or 5 per cent of starch natural to the bean. Its other constituents may be classed as fat, albuminoids, alkaloids, tannin, dextrin, colouring matter ("cocoa red"), and mineral matter. The alkaloids impart a stimulant character to the cocoa; they are termed *theobromine* and *caffeine*, and are closely allied to the alkaloids of tea. The following analyses, abridged from a number published by Dr. James Bell, will show the usual proportions of the constituents:—

ANALYSES OF COMMERCIAL COCOAS

	Trinidad Nibs.	Cocoatina.	Flake Cocoa.	Rock Cocoa.	Prepared Cocoa.
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Moisture	2.6	3.5	5.5	2.6	5.0
Fat	51.8	24.0	28.2	22.8	24.9
Added starch	none.	none.	none.	17.6	19.2
Cane-sugar	none.	none.	none.	32.2	23.0
Non-fatty cocoa	45.6	72.5	66.3	24.8	27.9
	100.0	100.0	100.0	100.0	100.0

The "non-fatty cocoa" of the Trinidad nibs contains about one-third of its weight of albuminoids, the other two-thirds consisting mainly of gum, tannin, cellulose, colouring and other organic matter. The nibs contain rather less than 1 per cent of alkaloids and about 3 per cent of ash.

Cocoa-essences are very similar to the "cocoatina" of which the analysis is given above, that is, they consist essentially of cocoa deprived of about one-half of its fat. Some contain, in addition, small quantities of added starch, sugar, or malt products. The average of several recent analyses of essences shows their composition to be as follows:—

Moisture	4 to 5 per cent.	Albuminoids	12 to 19 per cent.
Fat	25 " 30 "	Cellulose	5 " 9 "
Starch	5 " 6 "	Cocoa-red, tannin, &c.	25 " 42 "
Alkaloids	1 " 2 "	Ash	5½ " 8 "

The process of cocoa manufacture begins with the roasting of the nuts in a hollow globe of metal over an open coke fire. The roasted nuts are poured into a winnowing machine, where they are broken, and the husks blown away. The pieces are then ground between two revolving stones at a temperature of 100° F.; from the grinding machine the cocoa issues in a semi-fluid state to be caught in trays, whence it is transferred to hydraulic presses, which squeeze out the oily matter, or butter, as it is called. The blocks of pure cocoa which remain are again ground and sifted to a powder as fine as possible, and this powder is known as "essence of cocoa".

Dutch cocoas, and others of like character, have been treated with alkaline salts (compounds of ammonia, potash, or soda), with

the idea of softening the cocoa fibre and rendering it more digestible. These cocoas do not, as a rule, contain any added starch.

Granulated cocoa is mostly a mixture of nibs, sugar, and arrow-root.

Homœopathic cocoa is a preparation very similar to granulated cocoa, but with the sugar omitted.

Maravilla cocoa contains sugar and a good proportion of sago flour. **Iceland Moss cocoa** contains about 25 per cent of added starch and 30 per cent of cane-sugar. **Epps' cocoa**, according to an analysis advanced as evidence in a well-known case (*Gibson v. Leafer*) some years ago, is composed of—cocoa, 40 per cent; sugar, 44 per cent; and starch, 16 per cent.

It is thus a well-recognized practice to add starch and sugar to prepared cocoas. Nevertheless, except in the case of nibs, cocoa should always be sold as a mixture, or the vendor may be liable to prosecution under the Sale of Food and Drugs Acts. When the presence of alkali as an adulterant of cocoa is suspected, red litmus paper may be used to detect it. (A small book of this paper can be bought for a few pence from a chemist.) When the red slip is placed in a solution of cocoa the presence of alkali turns the red paper purplish or blue.

To Make Cocoa: "In a quart jug with a rounded bottom place a dessert-spoonful and a half of cocoa, and the same quantity of castor-sugar; add a tea-cup of milk and twice the quantity of water, and boil carefully. Stir up with a whisk, and serve."

The principal varieties of cocoa produced are Caracas, Trinidad, Surinam, Guayaquil, Grenada, Bahia, Cuba, Para, Java, and Ceylon cocoas. Trinidad now yields an excellent product, held by some to be best of all. The principal harvest in the West Indies is gathered at Easter and Christmas, but pods are produced all the year round. In Ceylon, where the mode of preparation is careful, the seeds, after being sweated, are washed free from the mucilage. After this they are slowly dried by being exposed for several days to a gradually increasing amount of sunshine. In Venezuela the seeds are "clayed", being sprinkled with powdered red clay, and rubbed in the hand to impart what is locally considered a pleasing colour.

Chocolate.—The better qualities of chocolate consist of a mixture of pure dried cocoa-paste and sugar, with a small quantity of some flavouring substance such as vanilla. The cheaper kinds contain added starch as well as sugar. Chocolate.
Analyses of ordinary chocolate used for the preparation of the beverage showed the average composition to be:—

Moisture	...	...	...	...	2 per cent.
Fat	...	...	...	...	40 "
Cane-sugar	...	...	...	...	20 "
Albuminoids	...	...	...	...	11 "
Ash	...	...	...	...	3 "
Cocoa-red, starch, tannin, &c.	...	...	...	...	24 "
					100 "

Chocolates intended for eating have a larger proportion of sugar, and a greater variety of flavouring matters. Besides vanilla, some of the substances used as flavourings are cinnamon, cloves, almonds, and musk. The following descriptions and recipes will give an idea of the kinds of articles generally included under the term "Fancy Chocolate".

Chocolate-creams consist of an outer shell of chocolate surrounding an inner mixture of sugar and fatty substance, usually cocoa-butter. Some varieties contain as much as 70 per cent of sugar.

French chocolate, according to one recipe, is made by rubbing 2 beans of Vanilla into a powder with sugar, and using 1 lb. of sugar to 3 lbs. of nibs.

Spanish chocolate:—10 lbs. of Caracas cocoa, 3 lbs. sugar, 1 lb. sweet almonds, $\frac{1}{4}$ oz. vanilla, $\frac{1}{8}$ oz. cloves.

Vanilla chocolate:—7 lbs. Caracas cocoa, 1 oz. Mexican vanilla, $\frac{1}{2}$ oz. cinnamon, and sufficient cloves to flavour. In another recipe "cloves and musk in small quantities" are used. (Blyth.)

The average weights of the packages of the various kinds of cocoa are as follows:—Trinidad, bags $1\frac{1}{2}$ to 2 cwts.; Grenada, bags $1\frac{3}{4}$ to 2 cwts.; Dominica, Jamaica, St. Lucia, St. Vincent, &c., barrels and bags $1\frac{1}{2}$ cwt.; Carupano, Sanchez, and Samana, bags 1 to $1\frac{1}{2}$ cwt.; Ceylon, bags $\frac{3}{4}$ to $1\frac{1}{4}$ cwt.; Caracas, St. Domingo, and African, bags 1 cwt.; Surinam, bags 2 cwts.; Bahia, bags $1\frac{1}{4}$ cwt.; Guayaquil, bags

Wholesale
Weights.

1 $\frac{3}{4}$ cwt. Cocoa butter is sold per lb. in cases of 2 cwts. net. Cocoa powder is imported in casks of 1 and 2 cwts. net, also in cases of 28 and 56 lbs. each, besides cases of 72 $\frac{1}{2}$ -lb. tins, and 144 $\frac{1}{4}$ -lb. tins.

7. CEREALS

All cereal plants belong to the natural order *gramineæ*. These are, botanically, grasses; having hollow stems, alternate sheathing leaves, and flowers arranged in either spikes or panicles. The chief varieties of cereal grains used for human food are wheat, barley, oats, rye, maize, rice, millet, and durra (dhurra). Of these, barley has the most northerly distribution, its *habitat* extending to within the Arctic circle. Then, coming southwards into the temperate regions, we meet with oats, rye, wheat, and maize in the order given; and finally rice, millet, and durra occur as the cereals of the tropics and sub-tropics. Maize is perhaps the most productive of all the cereals, and wheat comes next.

The substance of the cereal grain consists largely of starch (50 to 70 per cent). The granules of starch have different sizes and shapes characteristic of the respective cereals, and the various kinds are readily distinguishable from one another under the microscope. So also the husk surrounding the grain of one cereal has a structure different from that of other cereals. Hence it is possible, by means of the microscope, to distinguish the cereals in a mixture even when ground into flour—as, for example, wheat-flour and corn-flour; and this is the method which is usually employed to detect adulterations of one cereal with another. Speaking generally, it may be said that the constituents of all cereals are of the same kind in the main, but the proportions differ more or less considerably. Fat, starch, sugar, albuminous and other nitrogenous bodies, cellulose, mineral matter, and water, make up the substance of the grain in all cases. Oats are comparatively rich in fat and nitrogenous compounds, but poor in starch; rice is poor in the two former and rich in the latter; and wheat is intermediate in all three respects. This, at least, is shown by the results of certain analyses that have been made; but it must be remembered that rather considerable variations

occur in different specimens of the same cereal. The grocer is less concerned than the agriculturist with the plant itself, but as crops and prices are sometimes affected by questions of agriculture, it may be mentioned here that the commoner diseases of cereals are due to the growth upon them of certain parasitic fungi. *Bunt*, or "pepper brand" (*Tilletia caries*), is a very frequent disease of wheat; *smut*, or "dust brand" (*Ustilago segetum*), is common on barley, oats, and rye; and *ergot* (*Oidium abortifaciens*) is almost exclusively confined to rye, though it is occasionally found in wheat and other grain.

The wheat plant belongs to the genus *Triticum*, and occurs under many varieties. In this country two chief kinds are cultivated: ordinary "unbearded" wheat (*Triticum hybernium*), and bearded wheat (*Triticum aestivum*). Wheat and
Wheat Flour. These may be further divided into white wheats and red wheats. Some of the principal varieties of white wheat are *Talavera*, *Rough-chaff*, *Smooth-chaff*, *Chiddam*, *Hunter's*, and *Taunton Dean*; and of red wheat, *Golden Drop*, *Spalding*, *Lammas*, *Burrell*, *Nursery*, *April*, and *Revett's*, the last two being bearded.

Before grinding, the threshed grain received by the miller gets a preliminary sifting, to remove impurities such as earthy matter and husks which have been detached in threshing. The cleansed wheat is then ground and dressed. These operations separate the ground substance into some eight or nine products, distinguished according to the degree of fineness of the flour and the proportion of bran present. The following table will give an idea of the relative quantities of products which may be obtained from the milling of a quarter of wheat weighing 63 lbs. per bushel (1 quarter = 8 bushels = 504 lbs.):—

Yield from one quarter

Fine Flour	...	...	...	333 lbs.
Seconds	...	...	...	53 "
Fine Sharps or Middlings	...	...	...	16 "
Coarse Sharps	...	...	...	18 "
Fine Pollard	...	...	...	25 "
Coarse Pollard	...	...	...	26 "
Bran	...	...	...	26 "
Waste	...	...	...	7 "
				504 "

The average of a large number of results is given by Mr. A. H. Allen as follows:—

Yield from 100 lbs. of Meal

1st	} Fine Flour	...	...	70.2 lbs
2nd				
3rd				
Tails	...	...	...	5.3 "
Fine Sharps or Middlings		...		8.8 "
Coarse Sharps	...	...		3.4 "
Fine Pollard	...	...		2.4 "
Coarse Pollard	...	...		6.5 "
Long Bran	...	...		3.0 "
				<hr/> 99.6 "

The "fine flour" is that which is sold in the trade as "Households", "Whites", "Superfine", "Extra Superfine", "Patent", and so on, according to its quality.

The chemical substances which together compose wheat-flour may be classified as follows:—

(1) **Carbohydrates:** starch, dextrin, cellulose, and sugar. (2) **Nitrogenous compounds:** albuminoids (gliadin and glutenin). (3) **Fat.** (4) **Mineral matter** (ash). (5) **Water.**

According to a practical authority the finest flour at present found on the British market is that made from Hungarian wheat in the valley of the Theiss, a tributary of the Danube. It is milled at Buda-Pesth and neighbouring towns, being ground between steel rollers instead of the old-fashioned millstones. There are no fewer than eight grades, the finest, "No. 0", consisting of only five per cent of the wheat. Next comes the American wheat, the "spring wheat" (from Iowa, Dakota, Northwestern Canada, and elsewhere) being the flour most suitable for bread, while the "winter wheat" (from Ohio, Missouri, and Ontario) gives a grocer's flour, being fine-coloured, soft, and particularly useful for scones, biscuits, and general domestic purposes. The finest English and Scottish wheat, such as that grown in Lincolnshire, is much used for biscuits. Russian wheat is usually blended, and therefore apt to vary in quality.

Only small quantities of cellulose, sugar, fat, and mineral matter are contained in flour. Starch constitutes nearly three-fourths of its weight. Amongst the nitrogenous bodies the *gluten*

is of considerable importance, since it is to this substance that bread made from wheaten flour owes its porous and spongy character. Its deficiency in the other cereals renders them less suitable for bread-making. Crude gluten is readily obtained from flour by kneading it in a stream of water. The starch is gradually washed away, and there remains a sticky cohesive mass which can be drawn out into threads like so much bird-lime. The crude gluten consists essentially of the two bodies "gliadin" and "glutenin". It is the gliadin that imparts to wheat-flour the property of forming a stiff, elastic dough.

The Gluten
in Flour.

Within certain limits, however, the commercial value of a sample of flour depends rather on its physical than on its chemical properties. The chief factors, besides the flavour, are the "strength" and the colour. In a recent practical address, the lecturer said:

"The judging of flour was a very simple matter when gone about in the proper way. To grocers he would say: 'Don't depend entirely on your own judgment. Get a reasonably good sample from a miller of reputation, and have it baked by two or three of your customers in whom you have confidence, and who will give you a fair report.' In that way they would soon ascertain what were the characteristics of the flour. If the sample turned out fairly well, then they should order a small quantity—say half a ton. Every grocer had several confidential customers, who took a bag of flour at a time, and it was to these the samples should be given, so that if the flour was not satisfactory no offence would be taken, and the customer would not be running in fear to another man. If they got a flour which pleased and brought them repeat orders they might take it that such a flour was right, and could be safely stocked. It was a great mistake to be always changing their brands. Once they got in touch with a right flour to suit them they should stick to it."

"Strength."—The following simple experiment will sometimes give valuable information about the bread-making capacity of a sample of flour. It consists in ascertaining how much water is required to be mixed with a definite weight of the flour in order to form a dough of standard consistency. An ounce of flour is a convenient weight to take, and the water is carefully measured out from a graduated vessel. It is thoroughly mixed with the flour by stirring with a glass rod. The quantity of water used is then calculated into quarts per sack of flour. A flour which requires 68 quarts of water per sack of 252 pounds is regarded as of standard quality. One sack of such flour would make 95 four-pound loaves, or 380 lbs. of bread. This experiment is the determination of what is technically called the "strength" of the flour, the "strength" being defined as "the

measure of water absorbed in order to produce a dough of definite consistency" from a given weight of flour. As above described, there is room for some uncertainty as to when the proper consistency has been reached, especially when the operator is inexperienced. This difficulty, however, can be overcome by using Jago's "Viscometer", an instrument which has been devised for the use of bakers in making the "strength" test.

The common method of judging the colour of flour is what is known as Pékar's test. It consists in compressing a small quantity of the flour into a thin cake or slab, which is Judging Flour. wetted and allowed to dry: the depth and character of the colour are then observed. A rough-and-ready method of comparing two flours is to get even surfaces on them by pressing them with some object such as the smooth back of a watch, and then noting the colour of the surfaces. Pékar's test serves very well for the comparison of several samples at the same time; but for future reference it is necessary to have a permanent standard, such as Jago's "Colour Scale", which consists of a graduated series of tinted sheets of the proper size, and suitably mounted and numbered. For colour comparisons flours may be divided into two varieties, having gray and yellow respectively as their prevailing tones. Most flours belong to the gray class, but some of the finest patents, especially the Hungarian brands, have a rich yellow tint.

The mineral matter of wheat-flour consists of salts of potash, soda, magnesia, and lime, with a little silica, iron oxide, and alumina. The salts are chiefly phosphates. In an ordinary flour the amount of mineral matter (ash) never exceeds one per cent, and usually lies between 0.4 and 0.8.

Information as to Self-raising Flour, &c., will be found under BREAD.

Semolina is a granular preparation of the central part of the wheat grain. It is more especially made from wheats grown in sunny climates, such as Southern Italy and Spain, where the grain becomes hard and is rich in gluten. The millstones Semolina, Macaroni, &c. are so furrowed, or placed so far apart, as not to reduce the whole of the grain to flour, and the remaining granular fragments constitute semolina.

The product contains less starch and more of the nitrogenous

substances than average wheat-flour does; and on account of its superiority in these respects it is more valuable as a food than sago, tapioca, or arrowroot are.

Macaroni, Vermicelli, Spaghetti, and Italian Paste are all dried pastes of wheat-flour and water. Fine flour from hard Italian wheat is made into a stiff paste with hot water, pressed through tubular moulds or stamped into the required form, and gently dried or baked. Macaroni is the largest kind, vermicelli the next largest. Average macaroni contains about 10 per cent of moisture, 13 of albuminoids, and 70 of starch.

Macaroni is made of hard red wheat from the Black Sea, mixed with Italian wheat grown mainly in the plains round Foggia. This is ground into *semolina*, a very coarsely-ground flour; the bran and husks are removed, and the semolina kneaded in hot water till it has the appearance and consistency of dough. The dough is then placed in a vertical brass cylinder eight or nine inches in diameter, the bottom of which is a plate like the rose of a watering-pot, which is fine or thick according to the macaroni required. Thus, for making *vermicelli* and all kinds of solid macaroni the holes

How Macaroni
and Vermicelli
are made.

are very small, while for making the *tube macaroni* the holes are much larger. In the latter case also a conical blade is fixed in the middle of the hole to form the tube. The dough being placed at the top of the cylinder, it is driven down by hydraulic pressure through the perforated plate and cut off by hand in lengths of about three feet. It is then hung on canes in the sun to dry. In the case of solid macaroni there is no difficulty in grasping the process. In the case of the tubular macaroni the conical blade and its attachment cut through the dough and the macaroni issues with a slit all along it. This, however, shrinks together at once, and forms a perfect tube, the join being practically invisible. No macaroni is now made by the laborious hand process. There was for a long time a prejudice against machinery, but this has been overcome. The British Consul at Naples says the best macaroni is made at Gragnano and Torre dell' Annunziata. A little, also of the best quality, is made at Amalfi. In the last decade over 500,000 boxes were sent annually to the United States and about 70,000 to London, the remainder being sold in Italy.



The name "macaroni" means literally "pressed stuff", and comes from the Latin *maccaro*, the roller or cylinder used for its manufacture by the Romans. Originally confined to Genoa, it is now the national dish all over Italy, and has even passed into Marseilles and across to Algiers. In Italy it may be seen drying on long poles in the open air, and for sale everywhere in the streets. For a penny one buys a steaming plateful of it; a halfpenny more procures the addition of a cake; while if one is rich enough to spare still another penny he can accompany it with a pint of wine. The tubes or pipes of macaroni vary from the finest vermicelli to as much as an inch in diameter. It is also sold in fancy shapes, as mottos, sea-shells, letters of the alphabet, and many similar figures. As it comes in long sticks through the holes in the plates it is caught on poles and carried out to dry in the air and sun, a process which renders it much sweeter than if dried indoors. The fancy shapes are rolled in sheets under a press, and then stamped to the required figures.

Naples macaroni is sold in boxes of about 28 lbs., but the custom is to invoice at nominal not actual weight.

Barley is of more interest to the brewer than to the grocer. Barley grain is the fruit of the plant known botanically as *Hordeum vulgare*, of which several varieties are cultivated. The kind almost always grown for malting purposes in England is the "two-rowed" barley (*Hordeum distichon*). In some parts of Scotland the "six-rowed" barley (*Hordeum hexastichon*), known as bere (bear) or bigg, is largely raised for the same purpose. The weight of good barley varies from 49 to 58 lbs. per bushel, that of the best qualities being from 53 lbs. to 58 lbs. Bigg is generally lighter, weighing about 50 lbs. per bushel. The constituents of barley are, broadly speaking, similar to those of wheat, but probably the most important differences are in the "nitrogenous bodies". Barley contains less gluten than wheat does; and barley grown on light chalky or dry gravelly land contains less gluten than that raised on heavy soils, and is on this account preferred for malting. The process of malting consists essentially in causing the grain to partially germinate, whereby an active nitrogenous compound termed "diastase" is developed. This diastase has the power of converting the starch of the grain into sugar, which is finally fermented by the yeast

Facts about
Barley.

and converted into alcohol with more or less completeness. **Barley-meal** is used for pig and poultry feeding, and occasionally also for adulterating oatmeal and wheat-flour. **Pearl Barley** is barley grain which has been deprived of its husk, the grains being then further more or less rounded and polished. Sometimes they are dusted over with powdered chalk, in order to whiten them and improve their appearance. Pearl barley consists practically of the "endosperm" or inner starchy portion of the grain, the outer layers being removed. **Scotch Barley** is similar to pearl barley, but the process of rounding is not carried so far in the former as in the latter.

Under the microscope the starch-granules of barley-flour are closely similar to those of wheat-flour, and are difficult to distinguish from them without considerable practice. But as a rule some of the tissues of the husk can be found in the flour, and these are readily identified. Hence, when wheat-flour is suspected to have been adulterated with barley-flour, the microscopical examination of the particles of husk will often furnish important confirmatory evidence as to the sophistication.

The **oat**-plant belongs to the genus *Avena*, of which the two commoner species are *Avena sativa* and *Avena orientalis*. One of the best varieties is the "potato oat"; others frequently occurring are the "long black" or bearded oat, the white oat, the red oat, and the "naked" oat. Hot, dry climates are less suited to oats than those which are cool and moist. Hence soils and localities which are too cold and wet for barley or wheat will often grow oats in abundance. The wild oat is indigenous to England. **Oatmeal** as an article of diet was at one time in much more general use in this country than it is at present. At the end of the seventeenth century the consumption was estimated to be considerably greater than that of wheat. The latter, however, has gradually supplanted oatmeal as the staple bread-stuff in England and Wales; though in some parts of the kingdom, and more especially in Scotland, the oat still remains an important article of human food. In preparing oatmeal the ordinary oats of commerce are first kiln-dried, the husks separated, and the residual grain ground more or less finely. Scotch oatmeal is as a rule ground more coarsely than English, but the degree of fineness varies in both cases to suit

Oats and
Oatmeal.

the tastes of different localities. Derbyshire oatmeal, for instance, is a fine powder. The meal is not so white as wheat-flour, and it possesses a characteristic somewhat bitterish taste. Since it contains but little gluten, it cannot be made into light porous bread like wheat-flour can: the paste made from it lacks tenacity, and fails to hold the gas-bubbles which are necessary for imparting the desired porosity to the bread.

Scotch oatmeal is a household word everywhere. Commercially the term is applied to the meal produced in the north of England as well as in Scotland; and some of the best growths of north Ireland have the same characteristics. Of the imported, Canadian is usually preferred. In judging oatmeal by appearance—a matter needing some skill—a buyer should not pay too much attention to the whiteness of the meal; freshly made oatmeal is rather gray than white. In *storing oatmeal* remember that it quickly catches the flavour of goods in its proximity. An open bag of meal will be soon spoiled in flavour if near cheese or other odorous goods. The “nutty” flavour and good appearance will also depart quickly in our damp climate if the opened sack be placed at the shop door. If the oatmeal is kept in a bin, take care to inspect the bin periodically and keep it free of insects.

Analysis of a sample of Scotch oatmeal:—

Starch	...	...	...	...	...	59.9 per cent.
Cellulose	...	...	...	...	...	2.1 „
Sugar	...	...	...	...	...	1.3 „
Albuminoid bodies	...	...	...	...	...	19.8 „
Fat	...	...	...	...	...	7.7 „
Mineral matter	...	...	...	...	...	1.9 „
Moisture	...	...	...	...	...	7.3 „
						<hr/>
						100.0

Compared with wheat, oatmeal is rich in the flesh-forming nitrogenous constituents (albuminoids), and in fat, but rather poor in starch. In oatmeal the starch-granules are very much smaller than in wheat. They are also irregularly polygonal in shape, instead of being approximately circular like those of wheat and barley. As a consequence, barley-flour, which has sometimes been used for the adulteration of oatmeal, is very easily discovered when the suspected meal is examined under a microscope. Maize-flour and ground husks are detected by

Adulterated
Meal.

the microscope. A consular report from Maine (where the oat is the chief cereal) says: "Manufacturers of oat products are putting ground oat hulls on the market in many forms and mixtures, such as oat feed, oat chop, corn and oat feed, chop, &c. The bulk of all these materials is ground oat hulls, with admixtures of oat kernels, ground corn, &c. The feeding value is variable, as the oat hulls are not as digestible as the kernel of oats or other grains. Unscrupulous dealers frequently sell 'oat feeds' as ground oats, the unsuspecting buyer thinking he is getting the whole oat meal."

Groats are the whole kernel of the oat remaining when the husk has been removed. The grains may be more or less crushed in the milling.

Rye is the plant *Secale cereale*. It is grown on light soils, chiefly in the north of England. The product, however, is now of less importance than formerly, since rye-bread is practically unknown in this country. In flavour and nutrition rye-flour is inferior to wheat-flour, but it is still used in Russia and some other parts of the Continent. *Maslin* is a mixture of wheat and rye, grown occasionally in the northern counties for bread-making purposes. Rye-meal contains about 15 per cent of water, 8 of albuminoids, and 65 of starch. The grain is used to some extent for the manufacture of spirits, especially Hollands.

Maize, or Indian Corn (the South African "mealie"), is the product of the plant *Zea Mays*, one of the *gramineæ* or grass family. It is grown over immense regions, including the two Americas, the European continent, and large parts of Asia and Africa. The dried seed of the maize contains about 55 to 60 per cent of starch, 9 to 12 of albuminoids, and 5 to 8 of fat or oil. The starch in a more or less purified condition constitutes one variety of corn-flour. The oil can be extracted from the seed by pressure, and is sold commercially as "Maize Oil". The whole grain is used as human food in various forms: the American "Johnny-cakes" and the Mexican "tortilla" are cakes of maize-meal; the "polenta" of the Italians is a kind of maize-pudding; and the "hominy" of the United States is also a preparation made from crushed and sifted maize. In England this last form of maize is sold as "Corn Grits". "Pop-Corn" is made by baking the grains of maize when unripe.

The United States Consul in Yucatan has reported to his Government on some very interesting new food plants, the importance of which may justify a reference here.

New foods from Yucatan. Maize, or Indian corn (the South African "mealie"), is called "the grace of God" by the people of Yucatan, who have six varieties of it. The large-stalked, large-grained class known to the natives as *xnuc nal* (pronounced shnook nál) is the most prominent, and has by far the greater acreage devoted to its cultivation on the peninsula. It is planted in May, and when matured is left to harden and season until gathered as needed. This class most nearly resembles Indian corn. It has both the white and yellow grains. Under the hap-hazard methods of the native Indians the corn produces in the limestone soil of Yucatan from twenty to thirty bushels to the acre. Under favourable conditions this yield is often doubled. The *xmehenal* (shmehenál) is a small, quick-growing variety, about the size of "pop corn". The plants are rarely 4 feet high, and the natives have a saying that the cock can pick the flowers of the true *xmehenal* without stepping off the ground. One variety matures within sixty days of its planting, and the second needs but fifteen days more. The *xmehenal xtup* (shtoop), planted in May, can be gathered in July, and, while the production per acre does not quite reach the figures of the *xnuc nal*, it has a greater capacity for resisting the extremes of heat and dryness. The natives of Yucatan prefer the native corn to that imported from the States, and will cheerfully pay the higher price demanded in times of scarcity. They state that kiln-drying injures the grain. They allow the grain to harden and dry slowly in the ear upon the stalk. A running vine, known as the *macal box* (makal bosh), produces a tuberous root of great nutritive value. Entire families have lived upon this root for weeks at a time and were healthy and well nourished. This plant is very productive. About the middle of May the green shoots first appear above the earth. They grow rapidly, and in November are ready to be dug. The tuber is about the size of a large Irish potato, and is of a purplish colour, like a certain class of sweet potato. It can be cooked in the same way as the sweet potato. The plant is hardy. A long drought may cause the vine to wither, but with the lightest rain it springs up anew. The roots left in the ground as too small

for food propagate the plant, and each year the yield increases. It seems to be a kind of native yam; it grows in almost any kind of moderately rich soil, and when cultivated intelligently should be of certain value as a food plant. The *xmakin macal* (shmakeén makál), like the macal box, appears in May and is gathered in November, but it yields only one or two tubers to the plant. These, however, are of large size, resembling enormous Irish potatoes. The Consul has seen four of these great roots fill a bushel basket. The interior is white and seems to be nearly pure starch. It is planted as we set out potatoes. The plants grow close together, and the yield per acre is said to be phenomenal, so far as weight of product is concerned. *Xmehen chi-can* (shmehen chi kan) seems to be a kind of artichoke, weighing when mature about a pound. The plants are running vines rarely more than a yard long. An acre will yield an immense crop under favourable conditions. The plant, sown in August, can be gathered in November. *Xnuc chi-can* is a larger root, weighing when mature about three pounds. It is a hardy plant and produces well. Both of these roots are eaten roasted or boiled, and many like them raw.

We next come to that important cereal, **Rice**. The rice-plant, *Oryza sativa*, is largely grown in India, China, Burmah, tropical America, and the West Indies. Two chief kinds are recognized, upland rice and low or sea-level rice; but many varieties occur in the different countries. As a rule, the rice is grown in damp regions, or in those which can be frequently irrigated. Rice is harvested much as wheat is. The threshed and winnowed grain, still covered with the yellow husk, is called "*paddy*" in India and "rough rice" in America. This rough rice is then husked and sifted, giving chaff, broken rice, middlings, and prime, the last being considered the best grain. New rice is said to be less digestible than old. There are also certain differences between different kinds of rice when boiled: thus some varieties grown in India and used for curry have the grains remaining quite distinct after boiling, whereas in Carolina rice the grains break up and give a soft, mucilaginous food. Rice is less nutritive than wheat, inasmuch as it consists more largely of starch and has not so much nitrogenous substance. Good Carolina rice contains nearly 80 per cent of starch, and from

Rice and its
Characteristics.

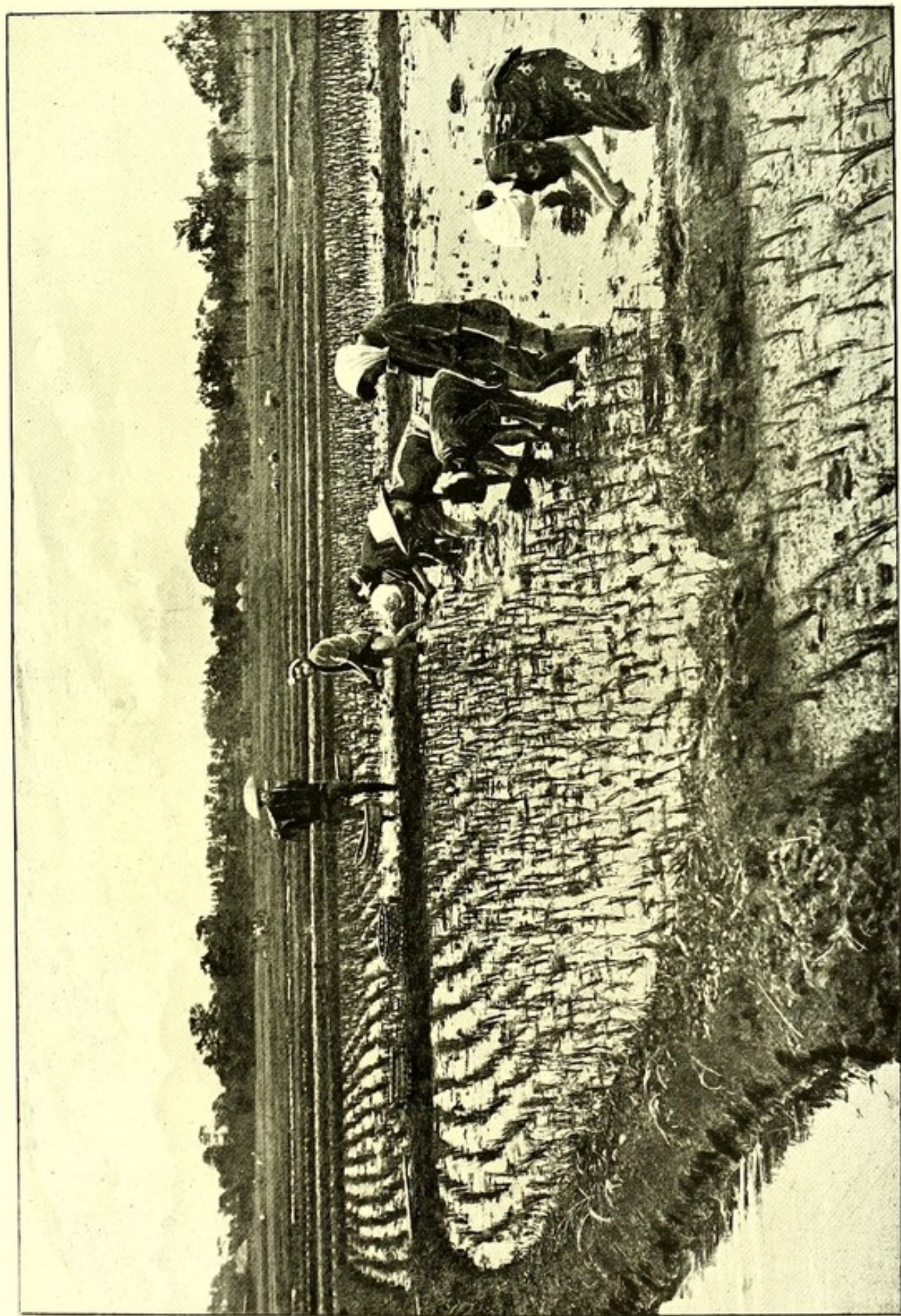
7 to 9 per cent of albuminoids, with about 10 per cent of moisture.

The chief kinds of rice imported into Britain are Carolina, Java, Patna, and Rangoon. Of these, the first, which is again being heard of after almost disappearing from our market, is regarded as by far the best, and Rangoon as of less value than the others. The Rangoon variety is grown in Burmah, where there are now extensive mills, large quantities being shipped thence milled ready for table use, while "rough rice", partly cleaned, is shipped for re-milling in Liverpool and on the Continent. It is said that as many as a hundred different varieties of rice are cultivated in India; the seeds vary in colour from white to red, brown, mottled, and even black. Indian rice is exported in the three classes of "Table rice", "Ballam", and "Moonghy", the last inferior. The harvesting of rice extends over nearly the whole year. Thus spring rice is sown, according to locality, from September to February and reaped from March to June; while summer rice, which is sown from May to July, is reaped from September to October. The autumn crop is sown in Bengal from April to July, and the harvesting extends from August to November; while the sowing of winter rice takes place from March to August, and it is reaped from November to January. The two chief varieties are those of winter and summer, which are occasionally sown mixed together and often accompanied by millet and a small kind of pulse. Two harvests are almost universal in Bengal, with an occasional third but smaller one. As a rule the earlier shipments turn out the best. The first shipments of new-crop Burmah rice usually begin in December or January—arriving here in February and March. Continental-dressed Rangoons arrive at earliest about March. In Carolina the cultivation of rice has been carried to a degree of perfection far higher than that of India, the science being better understood. Of all the American husbandries that of rice is perhaps the most picturesquely beautiful. The perfect level of the fields dyked against encroaching tides and intersected with canals and drains like so many veins and arteries, the shining sheet of water by which it is first covered, succeeded in a few days by a coat of emerald green, then a mixture of overflowing water and the green of the crop, finally the rich-

Carolina
Rice-fields.

A RICE-FIELD IN JAPAN

Rice, a native of the East Indies, is cultivated in the warm parts of Asia, Africa, and America, and even in parts of Italy and Spain. In Japan, whence our illustration is drawn, it is one of the staple foods of all classes. Among cereals rice is remarkable for the amount of water required in its cultivation. The rice may be sown on the fine mud left by the receding flood of rivers—the Nile in Egypt is a well-known example,—and it has been pointed out how literally the process exemplifies the verse of Scripture which says: “Cast thy bread upon the waters”. In the Patna and other rice-districts of India the rice is sown broadcast, after the commencement of the rains, on lands that have been thoroughly tilled and are soaked with water. After a month or six weeks, when the young plants are about a foot high, they are pulled up and transplanted into another field, being placed in rows from 2 inches to 3 inches apart. In some countries transplanting is not considered necessary, but everywhere abundant moisture must be supplied, either by irrigation or otherwise.



From a Japanese photograph

A RICE FIELD IN JAPAN



looking heads of a brilliant golden colour, drooping with a gracefulness unequalled by any other grain, are beauties which arrest the eye of the most commonplace observer.

Carolina rice is larger, sweeter, and better coloured than most other kinds. **Japan rice** is round-bodied and soft in grain, very suitable for puddings. It is one of the best kinds, and popular when it can be sold as a 2d. line. The finest table rice handled in this country is largely drawn from **Java**. It has been sometimes called "Carolina kind", but is now more generally known by its own name. **Patna** is a small variety of a slender white hard grain, and is esteemed for curries and for boiling purposes. **Siam** is somewhat similar. **Rangoon**, **Arracan**, and **Bassein** are good useful rices for general purposes at popular prices. The native-cleaned rice, such as "No. 2 native dressed Rangoon", is graded and exported under marks. In the process of milling rice great attention is paid to the grading, to secure uniformity; and as in what is called the "polishing" process, to prepare the grain for market, a large percentage becomes broken, there is a further grading known as "separation", whole unbroken grains being used for the higher-priced qualities and the rest graded downwards to smalls.

Ground rice is judged by colour. If it is of a dead chalky white it has probably been ground from the cheaper kinds, while **Patna** and **Java** are brighter, if less white.

Millet (*Panicum miliaceum*) is a small cereal whose grains are of about the size of a large pin-head. It is grown in great quantity in **India**, **China**, **Egypt**, &c., and serves as a staple food in these regions. White millet is sold in this country as a bird seed; but the cereal is not used here for human food.

Dari or **Durra** (*Sorghum vulgare*) is sold in **England** as a poultry food. It is a cereal largely grown in warm countries, and used as an article of diet by the **Arabs** and other nations. The meal from **durra** closely resembles that made from **Indian corn**, and is not easily distinguished from it even under the microscope.

Rice should not be stored on a stone floor or in a damp place, or it will quickly deteriorate in appearance. Be careful also that the warehouse is free from weevils.

Rice arrives upon this market in bags, of which those of rough rice weigh about $1\frac{1}{2}$ cwt. and those of cleaned rice 2 cwt.

A short outline of the method by which cereals are analysed will help the reader to better understand any certificate of analysis with which he may have to deal. Wheat-
How Cereals are Analysed. flour is selected as an example. (1) **Moisture:** 10 grams of the sample (1 gram = 15.4 grains) are weighed into a small tared basin, and dried in an oven heated by steam until there is no further loss of weight. The weight lost represents the moisture. (2) **Ash:** The dried residue from (1), or a fresh quantity of the flour, is carefully incinerated over a Bunsen burner or in a small furnace, until all the black carbonaceous matter has been burned away. The weight of the remaining ash is then taken. (3) **Nitrogenous bodies or albuminoids:** A small weighed quantity of the flour (1 gram or less) is heated with some very strong sulphuric acid for about two hours. The acid converts the nitrogen-compounds into ammonia. This ammonia is then liberated from the acid by distilling it with caustic potash. It is collected in water, and its quantity accurately determined by adding standard acid to it until its alkaline character is exactly neutralized. Every 17 parts of ammonia contain 14 parts of nitrogen; so that, the quantity of ammonia having been found, a simple calculation gives the amount of nitrogen contained in the flour, and which has furnished the ammonia. Then the nitrogen, multiplied by 6.3, gives the weight of albuminoids in the flour taken. (4) **Starch:** This is determined by converting the starch into sugar, as described under the article **STARCH**. (5) **Fat:** Four or five grams of the flour are dried and stirred up well with ether. The ether dissolves the fat. After the flour has settled down the ethereal solution is decanted off, poured through a paper filter to retain particles of flour, and received in a tared beaker-glass. The ether is then allowed to evaporate away, leaving the fat behind; the latter is then dried in a steam oven and weighed. (6) **Mineral adulterants** are detected by analysing the ash left in (2). The testing of flour and bread for *alum* is described under **BREAD**. (7) **Other flours or starches** are found by examining the flour with the microscope. (8) **Acidity:** 10 grams of the sample are weighed into a flask holding 200 cubic centimetres, and shaken up with pure distilled water to dissolve the acid. The flask being then filled with water up to the mark, the flour is allowed to settle, and a definite fraction—

half or quarter—of the liquid is decanted off. The quantity of acid in this is then ascertained by adding standard alkali until the acidity is just neutralized. An unsound flour has more acid than a sound one.

These determinations, together with the testing of the colour, flavour, "strength", and crude gluten as already described, constitute a fairly complete ordinary analysis of flour. The operations are essentially similar for the other cereals.

8. FARINACEOUS FOODSTUFFS

One group of these substances, comprising arrowroot, sago, tapioca, corn-flour, &c., may be described as consisting essentially of more or less purified starches. They exhibit one very important difference from the cereals, inasmuch as they are practically devoid of nitrogenous constituents—that is, of the flesh-forming materials—and therefore do not form a perfect food except when conjoined with other dietary ingredients. These various starchy foods are not necessarily obtained from the grains of the plants. It may be convenient to remember that rice is a seed, tapioca a root, and sago the pith of a tree.

Arrowroot is obtained from the rhizome or underground stem of plants belonging to the genus *Maranta*. The species *Maranta arundinacea*, a native of the West Indian islands and of the American tropics, is the most important member of the genus. It is now cultivated in Africa and Ceylon, as well as in other warm regions. Three other species of *Maranta* are known; of these *M. allouya* and *M. nobilis* grow in the West Indies, and *M. ramosissima* is a native of the East Indies. The rhizomes are sometimes a foot or so in length, and about three-quarters of an inch in diameter. Their outer layers contain a resinous substance which would give an unpleasant flavour to the arrowroot; hence it is necessary to carefully wash and peel the tubers before extracting the starch. The peeled rhizomes are then rasped or reduced to pulp by crushing. The pulp is afterwards washed with water on a sieve or washing-machine to separate the fibrous matter, the starch passing through the sieve with the

The Arrowroots
of Commerce.

water and subsiding in the tank in which the liquid is received. After being again washed with water to purify it, the starch is drained, and dried at a gentle heat. As much as one-fourth of their weight of arrowroot is yielded by the best rhizomes. Bermuda arrowroot is the most esteemed, and commands a very much higher price than other kinds. This is no doubt due to its reputation for purity, since the difference in price is hardly warranted by the intrinsic superiority of the Bermuda product. Thus St. Vincent arrowroot can be purchased at 5*d.* per lb. retail, when the price of the Bermuda article is 2*s.*, but the two makes are almost often indistinguishable from one another. Natal and St. Vincent now supply the great bulk of our imported arrowroot, and some is also furnished by the Cape and Mauritius.

Arrowroot was supposed by the South American Indians to be an antidote for poisoned arrows; hence its name. The Indian word *Ara-ruta*, or "mealy root", has also been suggested as a derivation. The chemical composition of arrowroot is very simple: the substance is practically all starch and water. Good varieties contain about 84 per cent of starch and 16 per cent of water. Various so-called "arrowroots" have at one time or another been placed on the market in competition with or in substitution for the *Maranta* product. "English arrowroot" is chiefly potato-starch, but may be a rice or maize preparation. "Portland arrowroot" was a starch obtained from the tubers or corms of the common *Arum* ("lords and ladies"), cultivated in the Isle of Portland: it is not now met with, except, perhaps, as an adulterant. Curcuma starch, obtained from the plant *Curcuma angustifolia*, is largely manufactured in India, and has probably often figured as "East Indian arrowroot" in the English market. "Brazilian arrowroot" is tapioca flour. These, with sago, and *tous-les-mois* (canna) starches, are the principal substances which have been used either as substitutes for arrowroot, or for mixing with it.

Sago is prepared from the pith of various palms belonging to the two genera *Sagus* and *Cycas* of the respective natural orders *Palmaceæ* and *Cycadaceæ*. The sago-palms (especially *Sagus*) are common in certain districts of India, in Ceylon, and in other islands of the Indian Ocean; while the cycads are indigenous to the Moluccas, China, and Japan. The principal

Sago and
Pearl Sago.

species from which the sago is obtained are *Sagus farinifera* and *Cycas revoluta*. A full-sized "palm" may be some thirty feet high, with a stem about six feet in circumference. When mature, it is cut off close to the ground, sawn up into six-foot lengths, and divided lengthwise to expose the interior of the stem. From this the pith is scooped out, and pulped up with water until the sago-starch has been detached from the woody fibre. The liquid, containing the starch in suspension, is then passed through a sieve to separate the fibrous matter. From the strained fluid the starch deposits upon standing quiet for a time; and this starch, after being several times washed with water and dried, constitutes the commercial *sago-flour*. The produce of a single tree is said to be sometimes as much as five hundredweight of sago.

Pearl Sago is made from the sago-flour by granulating it with sieves, after the flour has been mixed with water to form a paste. Mr. J. R. Jackson, of the Royal Gardens, Kew, who gives a description of the process, states that for granulating or pearling, the sifted sago is placed in a cloth, the ends of which are tied to a long stick, while it is kept expanded in a bag shape by a short cross-stick. A horizontal vibratory motion is given to this, the whole mass being kept in constant agitation, which lasts for about a minute, when the now granular sago is again passed through a sieve. The smaller grains which pass through are rejected, and those that remain are next put into a circular sieve, the bottom of which is formed of fine strips of bamboo crossing each other. The grains which pass through the square holes form the pearl sago of commerce in the unroasted state, those that are too large to pass are put back and again submitted to the same treatment. To assist the men the oblong sieves and the granulating-bag are sometimes suspended by rattans from the rafters of the factory. For the purpose of roasting, a row of iron pans are arranged in a platform of masonry; the pans, which measure $2\frac{1}{2}$ feet in diameter, rest in an inclined position partly against the back of the platform, which rises about a foot above the level, and partly on a small prop of brickwork on the right side. Into the top of this prop a plate is sunk in which a cloth saturated with water is kept. Behind each pan is an open furnace-mouth, the fire being carefully regulated so as to obtain a regular and moderate heat. Into

How Pearl
Sago
is made.

the pans a quantity of granular sago is poured, which is slowly stirred for a short time with a wooden instrument with a sharp curved edge. More sago is poured in, and as it hardens the stirring instrument is used more freely. After about three minutes' roasting it is removed to a table and passed through a round sieve. The grains that adhere to each other are thrown aside, and those that pass through form a smoking heap, which is allowed to lie undisturbed for about twelve hours. The grains are about the same size that they were before roasting, and some retain wholly or partially their white and mealy appearance, but the greater part have become translucent and glutinous, and all have acquired a certain degree of toughness although still soft. The final process is another roasting, which renders them hard and tough and greatly reduces their size. The pearl sago thus prepared and fit for exportation is put away in large open tins ready to be transferred to boxes or bags when sold. Though the mode of preparation and final drying differs somewhat in different countries, the process is practically the same.

The bulk of the pearl sago of commerce that comes into this country is imported from Singapore, and occurs in pearls of various sizes from that of a pin's head to a small pea. Occasionally, however, it is seen in pearls as large as a fine marrowfat pea. Commercially it is classified as small, medium, and large. The grains are hard, more or less translucent, and vary in colour from whitish to brownish yellow and even pinkish. One way of distinguishing between pearl tapioca and pearl sago is by noting that the former is white and the latter buff-coloured.

In China and Japan (says the authority above quoted) *Cycas revoluta* is known as the sago-palm of those countries, and from the stems a kind of sago is procured which is used as food by the people. From *Cycas rumphii*, a species growing in the forests of Malabar and Cochin, Southern Tenasserim and the Andamans, and often cultivated in India, a similar product, said to be of good quality, is also obtained from the stems. *Cycas circinalis*, a species met with in the mountains of Malabar and in Ceylon, furnishes from its seeds a sago-like meal, which is used as food in times of scarcity and made into cakes by the Cingalese. *Cycas pectinata*, a plant of Eastern Bengal and Burmah, yields a coarse sago, which is eaten by the hill people.

Far Eastern
Sagos.

From the nuts or seeds of *Cycas media*, an Australian species, an excellent farina is obtained similar to sago meal. To obtain it the outer cover is removed from the nuts, which are then broken and pounded and dried in the sun, after which they are put into a bag and placed in water for three or four days, when they are rubbed between two stones and so reduced to a fine paste and finally baked under hot ashes. In like manner the seeds of *Macrozamia spiralis*, a New South Wales and Queensland plant, are prepared by the native people as food. In the former colony it is known as the Burrawang nut. *Zamia integrifolia*, a West Indian species, being found in Jamaica, Cuba, and Hayti, furnishes from its root a quantity of starchy matter similar to sago. It has in recent years been made in large quantities in Florida for the Key West and West Indian markets, several large establishments being engaged in the industry. A cycadaceous plant well known in South Africa is the *Kafir bread-plant*, from the pith of which edible cakes are made. The plant is known to botanists as *Encephalartus caffer*.

Sagos
of the
Colonies.

Like arrowroot, sago is composed essentially of starch and water. A good sample of pearl sago will contain about 85 per cent of sago-starch and 15 per cent of water, with a small quantity of mineral matter, amounting usually to between 0.1 and 0.2 per cent. On account of its cheapness it is but little subject to adulteration, although trouble sometimes arises from confusing tapioca with it.

A **Brown Sago** (*Sagus fuscum*) comes from Borneo. **Portland Sago**, so called, is prepared from the roots of the arum lily. A sago procured from the Bahama Islands is the product of two cycads, plants belonging to the group which include the pine and the spruce. They grow to a height of some 2 feet, and one of them is commonly known as the sago-palm, though not a palm correctly speaking. The sago yielded is much used in Jamaica.

Tapioca is a preparation of the starch of the cassava, a plant belonging to the natural order *Euphorbiaceæ*. The bitter cassava (*Manihot utilisima*) is the most important of the tapioca-producing species; but the sweet cassava (*Manihot aipi*), as well as other species of *manihot*, are cultivated as sources of supply. Manioc, Mandioca, and Jatropa are other names by which the plant is known. The starch occurs in

Tapioca and
the Cassava.

the so-called "tubers" or "tuberous roots" of the plant, which are found in clusters of from three to eight, and are usually some 15 inches long, and about 4 or 5 inches thick. Like many other plants of the same order (which include the British spurge-worts and the caoutchouc-trees of America), the cassava contains a milky juice; this in the bitter cassava is highly poisonous by reason of the presence of prussic acid, but in the sweet variety it is innocuous. This poisonous property, however, is not retained even in the tapioca prepared from the bitter plant, since prussic acid is very volatile, and readily dispelled by exposing the juice to heat. To obtain the tapioca the farinaceous tubers are washed and scraped, and then rasped or ground down to a pulp. This pulp is then pressed to force out the juice, from which, after it has been allowed to stand undisturbed for a time, the cassava starch is deposited. When this starch has been separated, properly washed, and dried in the sun, it constitutes *tapioca flour* or Brazilian Arrowroot. "Brazilian arrowroot". When, however, the ordinary granular tapioca is required, it is prepared by heating the cassava starch, in a partially dried condition, upon a hot plate, keeping it stirred with an iron rod; this causes the starch-granules to burst, and their gelatinous contents then adhere together in smaller or larger nodules.

Practically all our tapioca comes from Penang and Singapore, although not grown there. Singapore tapioca, which is made by Chinese, is slightly cream in colour; the Penang is grayer. The article is known to the trade as "Flake", "Seed Pearl", "Medium Pearl", "Bullet", and "Flour". The latter is not used for household purposes. To make the "pearls" the tapioca pulp, after being washed sometimes eight or nine times, is pressed through sieves and dried on trays heated by wood-fires underneath. Or it is (as also described) placed in a cradle-shaped frame, slightly moistened, and subjected to a rotary movement which forms it into globules, and these while still soft are taken out and dried in the sun, lastly being fired in a shallow iron pan slightly greased with vegetable tallow. The "medium pearl" is sometimes re-manufactured in this country, being softened, rolled into flakes, and re-dried, when it is called "flaked tapioca" or "tapioca flakes".

Cassava bread, used by the poorer classes throughout South America, is made, like tapioca, from the roots of the cassava,

there called the mandioca or manioc. When mature, the plant is uprooted, and the roots are either cooked and eaten, or are made into "farinha". Two different kinds of "farinha" are made. One of these, the "farinha secca", is made by grating the root with a kind of large nutmeg-grater. The pulp thus obtained is then soaked for some hours, the water strained off, and the pulp dried over the fire in large pans. A coarse flour is thus obtained resembling oatmeal, which is generally eaten without any further preparation. "Farinha d'agua" is prepared by first soaking the roots until they become soft. Their pulp is then squeezed in a tubular cane apparatus, and afterwards dried and roasted in large flat pans.

Chemically, tapioca is almost identical with arrowroot and sago so far as its chief proximate constituents are concerned. It consists of about 85 per cent of starch and 15 of water, with small amounts of mineral and albuminous matters.

Cooking Tapioca.—For "boiled milk tapioca" take a pint of milk, a half tea-cup of tapioca, a half tea-cup of lump or Demerara sugar, and a pinch of salt. Boil in double sauce-pan for about four hours. For "baked tapioca" use the same quantities as above; add a piece of butter the size of a walnut; put into a pie-dish and cook for about four hours in a slow oven. Tapioca does not require soaking previous to cooking, and like all farinaceous foods it should always be cooked in a double sauce-pan.

The juice of the cassava or tapioca plant, drained away and boiled down, gives a thick black fluid called **Cassareep** or **Cassaripe**, much used as a basis for sauces.

Corn-flour is usually the purified starch of the maize plant (*Zea Mays*), but rice is also used. It is not a "flour" in quite the same sense as wheat-flour is, since much of the valuable nitrogenous part is removed by treatment with alkali during the preparation. On the other hand, corn-flour generally contains more of the nitrogenous substances than do sago and tapioca. It is, however, essentially a starchy food. Corn-flour is a frequent constituent of prepared foods for children, baking-powder, custard-powder, and such like preparations. "Oswego flour" and "Maizena" are two well-known brands imported into this country. British corn-flour is generally a preparation of rice-starch.

The average weights are: Sago, pearl, bags, 1 cwt. 1 qr.;

cases, 1 cwt. 14 lbs. Sago, flour, bags, 1 cwt. 1 qr. Tapioca, Wholesale
Weights. flake, E.I., bags, 1 cwt. 1 qr. 10 lbs.; Rio and Bahia, barrels, 1 cwt. 1 qr.; pearl, E.I., bags, 1 cwt. 1 qr.; flour, E.I., bags, 1 cwt. 1 qr. Arrowroot, St. Vincent, barrels, 1 cwt. 3 qrs.; tins, about 1 qr.; Bermuda, barrels, 1 cwt. 4 lbs.; half-barrels, 3 qrs.; kegs, 1 qr. 12 lbs.; Natal, cases, 1 cwt. 1 qr. 20 lbs.

The foregoing articles, as has been mentioned already, are substantially starches—that is, heat-producing and fat-forming foods. In the following group the proportions contain more of the nitrogenous and other compounds which go to the production of muscle and bone:—

Lentil-flour.—This is prepared from the seeds of the lentil plant, *Ervum lens*, a member of the natural order *Leguminosæ*. The plant is extensively grown in Egypt, Palestine, Arabia, Italy, France, and Germany. “Red lentils”, or “*Egyptian lentils*”, are imported from the first three countries: the French and German variety is smaller, and of a yellowish or brown colour; it is considered to be superior to the Egyptian. The fruit of the lentil consists of short, smooth, two-seeded pods, the seeds being about half as large as ordinary peas. They have a rather strong flavour, which some persons find objectionable, and which probably accounts for their somewhat restricted use in this country. Lentil-flour chiefly consists of starch, albuminoids, and sugar, with water and small quantities of fat, cellulose, and mineral matter:—

Starch	...	...	...	...	50.5 per cent.
Albuminoids	...	...	...	...	30.0 „
Sugar	...	...	...	...	3.5 „
Moisture and other constituents	...	...	...	...	16.0 „
					<hr/>
					100.0 „

The flour, by reason of its high proportion of nitrogenous substances (albuminoids), is highly nutritious. It forms the basis of several proprietary articles, being in these preparations mixed with other ingredients which serve to modify the flavour of the pure flour.

Revalenta is a preparation of lentil-flour. In one make the flour is mixed with barley-meal and sweetened with sugar. Other products of similar nature have been found to contain salt and

various flavouring materials, lentils, however, forming the chief nutritive ingredient of all.

Pea-meal.—The pea (*Pisum sativum*) and the bean (*Vicia faba*) are both highly nitrogenous seeds, and rank with lentils as regards their value as nutrients. Dried peas contain on an average about 10 per cent of moisture, 25 of albuminoids, and 50 of starch and sugar. Peas, like beans and lentils, are found by many persons to be somewhat difficult of digestion, with a tendency to produce flatulence. Pea-meal as human food is therefore generally used mixed with other ingredients; for instance, it is often employed in dessicated soups, and in compounding various military rations. "Maple", "gray", and "white Canadian" are some of the chief varieties of peas that are sold for poultry food.

Under the term "**farinaceous foods**" may be included a number of articles sold as specially nutritive products, prepared infants' foods, and similar substances. Their composition is naturally somewhat varied, but their general character will be gathered from what follows. Many contain lentil-flour as the basis, mixed with wheat-flour, corn-flour, rice-meal, or barley-meal, and flavoured with salt, sugar, celery-seed, &c. Others consist of wheat-flour, slightly baked or otherwise treated, and with or without sugar. Some are preparations of barley-meal, some of groats, and some of potato-flour; others are mixtures of pea-flour and arrowroot; and others again comprise one or more of the foregoing ingredients mixed with a proportion of malt or of malt-diastrase. The idea in using the two latter ingredients is that the malt or diastase, when the food is mixed with warm water, exerts a saccharifying influence upon the starchy matter of the food, and so renders it easier of digestion by infants and invalids.

9. STARCH

Starch occurs more or less abundantly in all plants. The quantities present differ very considerably: cereal grains contain 50 to 60 per cent, leguminous plants 30 to 40, and potatoes about 20, whilst in green vegetables only small amounts are found. For

commercial purposes, however, the yield of the plant per acre has to be considered as well as its starch-contents. For instance, although wheat contains three times as much starch as potatoes, yet an acre of wheat will only give about half as much starch as an acre of potatoes. This is because the weight of the grain produced is only about one-sixth of the weight of the tubers. Pure starch appears to the naked eye as a white, glistening, friable powder, though for sale purposes the powder may be compressed into blocks, or may appear as the well-known columnar or basaltic form of common laundry starch. Under the microscope it is seen to consist of small granules having various sizes and shapes—circular, ovoid, and polygonal,—the shape, sizes, and certain markings on the granule serving to distinguish the starch of one plant from that of another.

Three different classes of starch-manufacture may be distinguished, viz. the production of (1) edible starches (arrowroot, corn-flour, &c.—see FARINACEOUS FOOD-STUFFS); (2) laundry starch; and (3) starch for general technical purposes such as the sizing of paper and the manufacture of glucose.

Kinds of
Starch.

Laundry starch is largely made from rice. The granules of rice-starch are very small, lie more compactly together, and hence give a much better lustre than is obtained from wheat-starch. It is consequently preferred by laundresses, and is extensively manufactured in this country and in Germany. For general purposes potato-starch is largely used, the manufacture being chiefly carried on in France and Germany. A certain amount of wheat-starch is also produced in all three countries, though less than formerly; and maize-starch is made to a considerable extent in the United States.

The English method of obtaining rice-starch is essentially as follows. The rice is steeped for twenty-four hours in a dilute alkali solution (50 gallons to 100 lbs. of rice), the liquor drawn off, the rice washed with water, drained, and the now softened grains ground to flour under rollers. This flour is again steeped, in double the quantity of alkali this time, and the two treatments with alkali serve to dissolve out the gluten which had bound the starch-granules together in the grain. The liberated starch is then allowed to deposit, the alkaline liquor containing the gluten is siphoned off, the starch stirred up with a large quantity of water,

Rice-
Starch.

and then passed through sieves to separate it from fibrous matter. After passing the sieves the starchy liquor is allowed to stand for about seventy hours, during which time the starch settles down; the water is then drawn off, and the starch drained and dried. It is frequently "blued" with ultramarine at this stage.

Wheat contains more gluten than rice. The old or "sour" process of starch-making from wheat consisted in decomposing the gluten by fermentation, and then purifying the liberated starch by washing. In the newer methods the wheat is ground into flour, kneaded into dough, the starch washed out by jets of water, and afterwards purified by treatment with alkali substantially as described above. In potatoes there is no gluten to get rid of: the operations consist in cleaning the tubers, rasping them to a pulp, and separating the starch. This is done by washing the pulp with water upon wire sieves; the starch granules pass through with the liquid, and the coarser fibrous matter is retained. After being purified by washing, the starch is drained off and dried in a centrifugal machine.

Chemically, starch is what is termed a carbohydrate, consisting of carbon, with hydrogen and oxygen in the proportions in which these two elements exist in water. Its simplest formula is $C_6H_{10}O_5$ —that is, one molecule of starch contains six atoms of carbon, ten of hydrogen, and five of oxygen, in combination. It is easily converted into glucose (sugar) by boiling it with a little dilute acid, and large quantities are thus employed in this country and on the Continent, the glucose being used for brewing and jam-making purposes.

In Egypt starch manufactured from either wheat or corn is used extensively in the preparation of Oriental sweets, the best known among these being the so-called "rahat lakhoum", which finds a ready sale in the Eastern market.

Dextrin, or British gum, is obtained from starch by the action of acid as in the case of glucose, but without boiling so long if a boiling process is employed—which is, however, not essential. One commercial method is to moisten the starch with nitric acid, allow it to dry in the air, and then heat it to $110^{\circ}C$.

Fecula and **Farina** are general terms denoting any starch or starchy substances. As a rule, "fecula" is synonymous with starch and "farina" with flour, but both names are used rather loosely.

A characteristic test for the presence of starch in any substance is the production of a blue colour when the material is mixed with a little tincture of iodine. The *amount* of starch in a mixture is ascertained in some cases by counting the number of starch-granules under the microscope, and comparing these with mixtures made up to contain known quantities of starch. In other cases, and especially when the proportion is large, the starch is converted into sugar by boiling with dilute acid as above mentioned, and the amount of sugar produced is then determined by one of the methods given under the head of SUGAR. From this the quantity of starch is readily calculated, since it is known that 90 parts of starch yield 100 parts of sugar (glucose).

10. DRIED FRUIT, &c.

Under this designation the following articles are generally included:—**Almonds, Currants, Dates, Evaporated Fruits, Figs, Plums and Prunes, and Raisins.** It will be convenient to describe them in this order, and a section on **Fancy Fruits and Peel** is added.

(1) **ALMONDS.**—Botanists include the Almond in the natural order of plants called the **Rosaceæ**, which furnishes our most valuable orchard-trees, such as the cherry, apricot, and plum. The sweet and the bitter almonds are varieties of the plant known as *Amygdalus communis*,¹ and are distinguished as *Amygdalus dulcis* and *Amygdalus amara* respectively. There are no very obvious differences between the two trees in general appearance. The almond is thought to be a native of Persia and the northern coast of Africa. It flourishes, however, over a great part of Southern Europe, and also in Palestine, Syria, the Canary Islands, and North China. It grows admirably in California, and fairly well in Florida. In England the tree sometimes produces fruit, but our climate is not quite warm enough to ripen it properly, and the produce is very inferior from the commercial point of view. The plant is a small tree, growing to a height of about 15 to 25 feet, and bearing oblong, lanceolate leaves with serrated edges. Its fruit is what botanists call a

¹ By some authorities the tree is named *Prunus Amygdalus*.

Sir JOHN MARK is honourably identified with the grocery and wine trade of Manchester, where his labours in various public offices led to his receiving the honour of knighthood. He was Mayor of Manchester in 1890 and 1891, and is a justice of peace for the city and for the county of Lancaster.

Mr. JOHN WILLIAMS, of Manchester, was for some years president of the Manchester Grocers' Association and of the Northern Council of Grocers' Associations, which he may be said to have founded, and has taken a leading part in the organization of the retail trade, in which he is universally regarded as one of the chief practical authorities. He and his sons have shops in Manchester and its suburbs, and it was as "Williams of Didsbury" that he first made a name in the discussions of practical matters by the retail grocers and provision dealers.

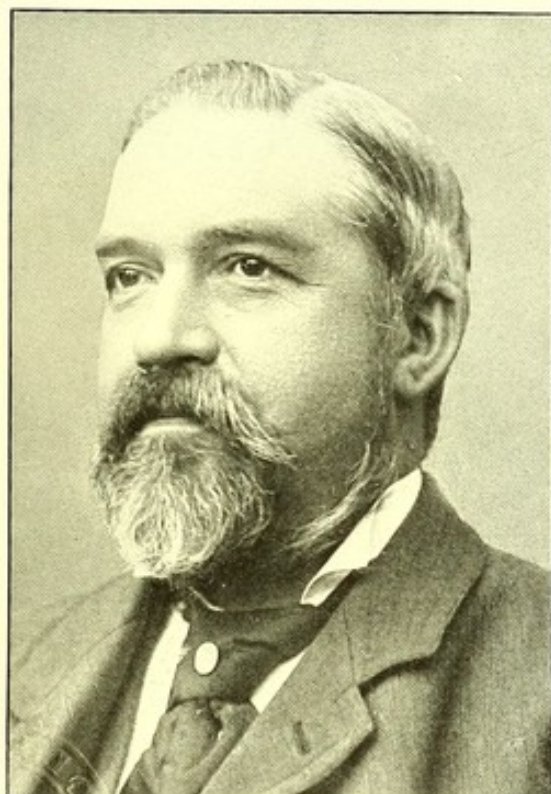
Mr. C. R. BURGIS, J.P., chairman of the firm of Burgis & Colbourne, Ltd., is widely known and respected in trade circles as an expert authority on matters connected with the grocery and allied trades, as well as an earnest supporter of movements for the uplifting of the trade and the raising of its moral standard. He was one of the earliest members of the Grocers' Federation, and is the respected president of the Warwick, Leamington, and Stratford-on-Avon Grocers' Association.

Mr. DANIEL MELIA is the founder of Daniel Melia & Co., Ltd., which is a company carrying on business at nearly 100 retail shops in the grocery and provision trades. As the pioneer of the many-shop system he enjoys both wide influence and a high reputation.

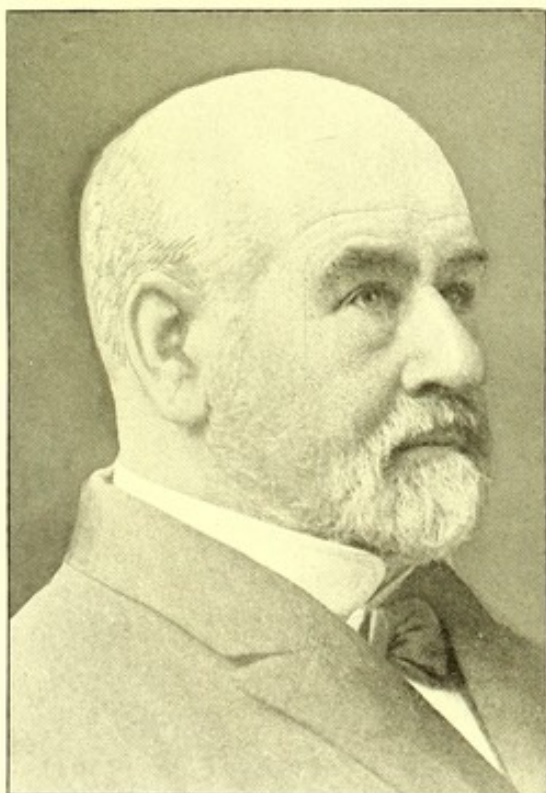
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"drupe"—that is, a stone-fruit like a plum, for example—and is made up of four portions. Externally there is a downy covering; inside this is a layer of fibrous tissue; inside this again is the shell, which surrounds the central kernel. The whole fruit is more or less egg-shaped, and varies in length from about 1 to 2 inches. In the ordinary varieties of the plant the flowers are of a fine pink colour. Almonds do not thrive well in soil which is either too heavy or too light: a deep, warm, dry soil, mixed with small stones, suits them best. In Italy the almond-tree begins to bear fruit at four years, and is in full bearing at about fifteen years or more: it seldom fails until sixty years old or so. When the fruit is ripe it is knocked off the tree with light rods or reeds, collected, and prepared for market by removing the outer covering. The yield of a good average tree in France is said to be about 13 to 14 lbs. of shelled almonds, which sell locally at 5*d.* to 6*d.* per lb. (1 franc per kilog.). In California a tree will bear about 20 lbs. of produce, and the yield of an acre is calculated to be worth about £100.

The favourite varieties of almond for cultivation are the following:—**Tender-shelled:** This is the kind sold as "Jordan" almonds. The fruit is oval in shape, $1\frac{1}{2}$ inch long and 1 inch across, with one side convex and the other nearly straight. Shell fibrous, containing a large sweet white kernel. This variety ripens in August. **Large Sweet:** Fruit about 2 inches long; kernel, which is sweet and of excellent flavour, about $1\frac{1}{2}$ inch in length. Ripens early in October. **Common Sweet:** Fruit $1\frac{1}{4}$ to $1\frac{3}{4}$ inch long; skin pale-green; kernel sharp at the ends. Ripens about end of August. **Pischoe:** A small, blunt-pointed fruit much grown in the south of France. About $1\frac{1}{4}$ inch long, and covered with fine down. Shell resembles a pistachio in size and shape, and encloses a sweet, pleasant-flavoured kernel. Two other favourite French varieties are "Princess" and "Lady" almonds.

Varieties of
Almonds.

In addition to the natural distinction of "sweet" and "bitter" varieties, almonds are also commercially distinguished as "shelled" and "unshelled", or "almonds in the shell".

Sweet Almonds: These are usually classed in the London market as **Jordan**, **Valencia**, **Sicily** (or **Italian**), and **Barbary**; and the prices are generally in this order. Other kinds of less importance are known as *Persian*, *Bari*, *Oporto*, *Canary*, &c.

Jordan Almonds are the most prized, on account of their superior flavour; the price obtained for the finest sorts ranging up to about 285s. per cwt. They come from Malaga, and two varieties are recognized: one of these is a flat almond with clear, thin, cinnamon-brown skin, rather tough, sweet, and about an inch in length; the other is plumper, more pointed, and more or less brittle. The shells are thick and hard. **Valencia Almonds** are also esteemed as a superior sort. They are broader than the Jordan and rather shorter; flat, obtusely pointed at one end and broader at the other, with a dingy-brown, dusty-looking cuticle. **Sicily and Barbary Almonds** are more or less similar to the Valencia, but are generally smaller and not so flat. The Barbary almonds are among the first to arrive, usually in September. Sweet almonds have a bland taste, and when triturated with water form a white emulsion without any marked odour.

Bitter Almonds are grown from varieties of trees very similar to those which are cultivated for the sweet article. French, Barbary, and Sicily are the chief kinds; of these the French are the largest, then come the Sicilian, and next the Barbary. The last is the most common; it is darker than the French, and closely resembles the Barbary sweet almond. It is imported chiefly in boxes from Barbary and Mogador. The French almond-industry centres round Aix and Salon in the south, and the product is shipped at Marseilles. Bitter almonds, though often almost indistinguishable in appearance from the sweet kinds, are sharply marked off from the latter in respect of their composition, since they contain a quantity of the glucoside *amygdalin*, which is not present in sweet almonds. This glucoside is a compound of sugar (glucose) with "oil of bitter almonds" and prussic acid. The latter substance is of course a deadly poison. It is easily "split off" from the amygdalin when the almonds are treated with water, and is then in the free state, in which it can most readily exert its poisonous action. Consequently, bitter almonds should be used only with circumspection in cookery or confectionery, and care should be taken not to supply them in mistake for the sweet variety. It might perhaps seem dangerous, from what has been said, to use bitter almonds at all in articles of food. But the fact is that prussic acid is a very volatile substance, and is therefore pretty easily dissipated

by the heat in cooking, so that the danger is really much less than might be thought. Nevertheless, it is necessary to beware of unguarded and indiscriminate use of the bitter almond. The chief simple distinctions between this variety and the sweet almond are: (1) the bitter almond is generally somewhat shorter than the sweet, and proportionately broader; (2) it has a bitter taste; and (3) triturated with water its emulsion emits a characteristic odour.

An essential oil, used in perfumery and for flavouring purposes, is extracted from the kernels of bitter almonds by distillation. Another kind of oil, clear, fatty, and almost devoid of taste and odour, is expressed from both bitter and sweet almonds, and used for the general purposes of a fine oil.

Almonds in the shell come mostly from Faro and Tarragona. From Spain the almonds are as a rule shipped in boxes containing 28 lbs., inferior qualities in bales of 224 lbs. each.

Green Almonds are the young fruit of the sweet variety, sometimes preserved in sugar. **Burnt Almonds** are the roasted sweet kernels; they are used as a sweetmeat when made up with sugar, or, alone, are employed to colour and flavour various liquors. **Blanched Almonds** are sweet almonds from which the skin has been removed. This is done by soaking them for a short time in hot water, and taking off the skin with the fingers; the almonds are then rinsed in clean cold water, and either wiped dry or slowly dried in a warm place. Dried in this last manner, and crushed small, they form **Ground Almonds**. **Salted Almonds** are also bottled, and **Sugared Almonds** are a well-known sweetmeat.

Almond
Prepara-
tions.

(2) **CURRENTS** are the dried fruit of the Corinthian grape, a seedless variety of the ordinary grape-vine, *Vitis vinifera*. All the vineyards producing the Corinth currant are situated in the Peloponnesus, the Ionian Islands, and Eupoca, and all attempts to introduce its cultivation into other parts of Greece, as well as Europe and California, have hitherto failed, an entirely different grape being produced. Cephalonia, Ithaca, and Zante are noted for their currants, and Patras is the chief emporium for the fruit. The currant-vines grow best on calcareous marl soil, in the low-lying lands or near the sea-coast. They are generally planted some 3 or 4 feet apart. Grafted plants bear in about three years;

those propagated by slips and layers in the sixth year. The grapes are small and round, with thin skins; they ripen about the end of July, and the principal month for the vintage is August. When The Currant Vintage. rather over-ripe and nearly black the berries are gathered, spread upon sheets, and exposed to the heat of the sun until dry. When the curing operation is finished the currants fall from their stalks, or are detached by gentle switching; the stalks are separated by sieves, and the dust and fragments of leaves, &c., are then winnowed away from the currants by means of a fan. The dried fruit is then packed in casks and cases. Like other vines, the currant plant is very liable to be attacked by the *Peronosporus* fungus. During the drying of the fruit, too, much mischief may be done by rain, which is greatly dreaded at the curing season. A "retention law" is enforced in Greece, which enacts that a certain percentage of the currant crop shall be kept in the country; and in 1905 the Greek Government granted a monopoly contract to a company, whereby the trade is to be controlled for twenty years. New season's currants begin to arrive in this country about the first week in September. The kinds most esteemed are **Panariti** and **Vostizza**, choice parcels of either kind usually fetching high prices. *Gulf*, *Zante*, and *Patras* may be described as good medium produce; then come *Amalias*; and last on the list of the ordinary varieties are *Provincials*, which are a staple low-priced quality.

Currants, being packed at a rather dry season and in a warmer climate than ours, may gain a little in weight through absorption of moisture when kept in bulk in the damper atmosphere of this country. On the other hand, if they happen already to have nearly as much moisture as they can take, they are liable to lose weight when exposed in small quantities for weighing out, particularly if the air happens to be dry or if they are stored afterwards in a very dry place. Currants should only be washed and cleaned as wanted for use, as, if kept long in a wet state, moulds and ferments are liable to develop upon them.

Currant Cake.—2 lb. flour, 4 oz. butter or clarified dripping, $\frac{1}{2}$ oz. caraway seeds, $\frac{1}{4}$ oz. allspice, $\frac{1}{2}$ lb. pounded sugar, 1 lb. currants, 1 pint milk, 3 table-spoonfuls fresh yeast. Rub the butter lightly into the flour, add the dry ingredients, and mix well together. Make the milk warm but not hot; stir in the yeast, and with this liquid make the whole into a light dough; knead well, and line the cake tins with strips of buttered paper, about 6 inches higher than the top of the tin.

Put in the dough; stand it in a warm place to rise for more than an hour, then bake the cakes in a well-heated oven. Time— $1\frac{3}{4}$ to $2\frac{1}{4}$ hours.

Currant Bread.—2 lb. flour, 2 tea-spoonfuls of salt, 1 oz. of yeast (German), 12 oz. currants. Sieve flour and salt, mix in currants with flour. Make a hole in centre and crumble yeast into it. Add $\frac{1}{2}$ pint of tepid water, then let it stand for fifteen minutes. Then add another $\frac{1}{2}$ pint of tepid water and knead for five minutes. Let this stand in a warm place covered with a cloth for thirty minutes, then make into loaves and let them stand for twenty minutes. Bake in moderate oven for about thirty minutes.

(3) **DATES.**—Dates are the fruit of the date-palm, *Phoenix dactylifera*, a tree belonging to the natural order of *Palmaceæ*. The hot and dry climate of North Africa—Algeria, Morocco, Tunis, Egypt—and of Arabia and Persia is that in which the edible varieties flourish best. The tree is one of the most useful in the world. The trunk supplies timber for houses and fences, and wood for fuel; the leaves form baskets, bags, mats, fans, brushes, walking-sticks, ropes, cords, roofs, and walls; and the fruit the chief food to millions of people in Arabia, Barbary, &c. Spirits, sugar, honey, and vinegar are also made from it. A liquor, known as palm-wine, or latchby, is obtained from the sap of the date-tree. Even the young shoots and the tender unfolded leaves are also eaten as palm-cabbage, while oil, “date coffee”, and cattle-food are made from the stones. The date-palm yields at seven years, and may produce for 200.

A Tree both
Handsome
and Useful.

The most singular process in the culture is the “marriage of the palms”, which, in the blossoming period of spring-tide, gives the date-gardener plenty to do if he would have a fine crop. The female trees, or pistillate palms, are much more numerous than the staminate. To accelerate the fertilization the husbandman must climb the tree and sprinkle the pollen while the bloom is fullest.

There are many varieties of the date-palm; in the oasis of Libau alone about ninety are said to be found. The fruit intended for the best dates is gathered before it has quite ripened, then dried or cured in the sun to make it keep, carefully packed, and afterwards sent to market. The fresh dates cannot be kept very long without some kind of treatment, as the sweet juice which they contain soon begins to ferment. For “squashed” dates the fruit is allowed to remain on the tree until it is perfectly ripe, when it is gathered and pressed into baskets.

Tafilat, Tunis, Egyptian, Bassora, and Persian dates are some of the chief kinds imported into this country. Tafilat and similar

dates are considered as the best; they are grown in the Morocco hinterland some two or three hundred miles from the coast, and reach this country *via* Tunis. Biskra and Southern Algeria produce considerable quantities of dates, but it is claimed that those grown in Tunis are of a much better quality.

A great many varieties of dates—some natives say as many as 200 kinds—are grown in the Trans-Atlas region. The kind which is exported is known as the “Majhol”. It is large, luscious, very sweet, of a greenish brown when fully ripe, and has a fairly large stone. Though so much liked in Europe, it is not, strange to say, held in much favour by the natives themselves, they, as a rule, preferring the smaller and drier varieties. The smallest kinds of all are excessively cheap, and are used principally to feed horses and cattle. The dates reserved for local consumption by man and beast are treated in many ways, the most curious preparation being the one for Arab travellers’ use, in which the fruit is pressed into masses almost as hard as sea biscuit. The mass is much the same in colour, too, and, being composed of dates of the small dry variety, is far less sweet than one would expect, and less provocative of thirst, while its nourishing and sustaining power as a food is very high. The dates for export are loosely packed in baskets and conveyed by mule caravans to Fez and, to a much smaller extent, however, to Morocco City. At Fez they are sold by public auction in the market. The ripest, the smallest, and those least likely to keep good are disposed of to retailers for local consumption and sale in other Moorish towns, while those of attractively large size, comparative dryness and soundness, are loosely packed in paper-lined wooden boxes, with an outside covering of brown canvas, each containing about 45 lbs. to 50 lbs. avoirdupois. In this state they reach the London market. The crop reaches Fez from October 15 to December 30, and the first lots are usually keenly competed for, as the prices obtainable for consignments delivered in London before Christmas are much higher than afterwards. The London prices vary according to circumstances, from as high sometimes as 110s. per cwt. in a brisk season for good lots delivered before Christmas, to as low as 30s. or so for consignments meeting a dull market, or sold in January and February. In

London the dates undergo further picking, the best being retailed in fancy boxes, and at equally fancy prices, much like candied preserved fruits. Of late years some dealers in Fez have tried to improve the consignments by increased care in selection, and packing the best dates in small boxes of 2 to 4 lbs. each, 10 to 20 of which are enclosed in one of the canvas-covered cases alluded to.

"Degla" are the best Tunis dates; other varieties, much inferior, are known as the "bserr" and the "horra" kinds respectively: probably few or none reach this country.

Fine dates come from Egypt *via* Alexandria, and from the region eastward of this *via* Smyrna. They are larger than the Tafilat dates when new, but do not keep their condition so well. "White dates" also come from Egypt: these are a small, white, smooth variety about as large as acorns. Of the Bassora, Bussora, or Bagdad dates, which are grown in the districts skirting the Persian Gulf, the chief qualities are the **Hallowie**, the **Khadrowie**, and the **Siars** or **Sairs**; **Persian Siars** are also imported. The *Hallowie* is considered the best of these, closely followed by the *Khadrowie*; the former is a honey-flavoured fruit of golden yellow colour; the latter a reddish-brown, fleshy date. *Siars* are a dark-coloured variety. *Koorsi* and *Zahdi* are other kinds of Bagdad dates. Speaking generally, the Arabian and Persian produce fetches a lower price in the English market than the Egyptian, and of course still less than the Tafilat article.

Dates, especially the inferior kinds, are occasionally attacked by a parasitic fungus, and soon rendered unsaleable. The parasite is known as "date-smut"; it acts on the dates much as wheat-smut does upon cereals, transforming the tissues into a powdery mass largely made up of the spores of the fungus.

Plump, fleshy dates will naturally be chosen in preference to those which are harder and drier. Size and colour are also points to bear in mind, as well as flavour and sweetness.

(4) **EVAPORATED FRUITS.**—Under this description the chief articles handled in this country are Apples in various forms—*e.g.* as Apple Rings, Sliced Apples, Normandy Pippins, and so on. But Pears, Plums, Peaches, and Apricots are also preserved to a considerable extent by the "evaporation" processes, and to a smaller degree such fruits as Blackberries, Cherries, and Rasp-

berries are evaporated in the United States. There are three principal methods of fruit-drying practised in America and Canada: viz. cold-drying, hot-drying, and vacuum-drying. These are carried out as follows:—

(i) **Cold-blast process.**—So far as mere *curing* of the fruit is concerned, heat is not necessary—in fact it is rather injurious. It is used because, ordinarily, the fruit is dried more quickly with heat than without it. But the advocates of cold-drying claim that when the fruit is dried at a low temperature it retains its flavour better than when heated, and keeps just as well. This has led to the introduction of the cold-blast method, which consists in desiccating the fruit without heating, by means of air which has been previously dried. The fruit, peeled, cored, and sliced as desired, is distributed on shelves round a chamber in which is placed a quantity of calcium chloride—a chemical which absorbs moisture from the air with great avidity. Compressed air which has already been deprived of its moisture is then admitted to the chamber, and this carries off the water which is evaporating from the fruit, so that eventually the latter becomes dry enough to keep.

(ii) **Hot-air process.**—This is the method mainly used, both in Europe and in America. In the latter country small evaporators for domestic use are made on the same principle, in addition to those employed on the large scale. The fruit, pared, cored, and shredded if necessary, is spread upon trays or screens made of galvanized wire, and placed in the evaporator. The latter is a three-storied chamber, through which passes a current of air heated to about 240° F. The trays rest upon endless chains, which move upwards every few minutes, when a fresh tray is put on below and a finished one taken off at the top. The evaporation proceeds very rapidly.

(iii) **Vacuum system.**—Some of the features of both the above processes are used in this system, combined with the advantage of a partial vacuum. The vacuum-pan containing the fruit is warmed to 120°–170° F., and air, previously dried by passage over calcium chloride, is alternately let in and exhausted from the pan, carrying away with it the moisture from the fruit. The whole operation of drying is completed in about twenty minutes.

The coring of the fruit is done with a copper punch, as steel at

once discolours it. With pared fruit the evaporating process is finished when the proportion of water left in the fruit is brought down to about 12 per cent, but fruit which is dried without peeling—*e.g.* plums, or in some cases apples and pears—can have still more water left in them. If plums are to be put on the market without stones, they are kept first at a temperature of about 90° F. until they have thoroughly shrunk. Then the plum is slowly pressed at one end; the stone issues from the other; and on further drying, the aperture thus made closes up almost completely. If plums or peaches are to be dried without their skins, they are plunged for a few seconds into boiling water. The skin can then be easily removed by the fingers. When such fruits as plums, peaches, &c., leave the drying chamber they are cooled as quickly as may be, since experience shows that they then retain a good lustre, while slowly-cooled fruit shrivels and has an unattractive appearance.

In Germany and elsewhere some objection has been raised to American evaporated apples on the ground that they may contain more or less zinc and be therefore detrimental to health. No doubt there is some little foundation for this suspicion; the malic acid of the apple-juice may, if the sliced fruit is dried upon trays of perforated zinc, or even of galvanized wire, dissolve traces of the metal. But probably the danger has been greatly exaggerated, as the amount of zinc thus taken up can only be infinitesimal. Nevertheless the apple packers have to bear this prejudice in mind, and there is reason to think that they now take every care to avoid giving justification to the objecting interests. Both the United States of America and the Dominion of Canada, which are great producers of apples, do an immense export trade in dried apples, amounting to millions of lbs. per annum. Almost the whole of the Canadian export is supplied by the province of Ontario. The best fruit is light in colour; that which is brown is looked upon as old and inferior. Whole-cored Newtown Pippins are a favourite sort from California. From France come the well-known Normandy Pippins, a small spotted variety put up in baskets and bags for export. These are evaporated or sun-dried in Normandy to a considerable extent, and are also prepared in America. They are of a brownish colour when dried. Dried pears reach this country largely from both Normandy and California, baskets of

about 5½ lbs. net weight being a favourite package of the French fruit. Dried apricots, peaches, and plums are also extensively imported from California, prepared in one or other of the ways which have been described,

(5) FIGS.—The fig is one of the oldest cultivated fruits, and is very wide-spread, occurring almost everywhere in the warmer temperate regions and sub-tropics. It ripens in sheltered spots in the South of England, and is found quite commonly in Southern Europe, Palestine, Asia Minor, North Africa, Persia, India, and Afghanistan, whilst the tree has been naturalized in California and in Australasia. The Mediterranean region, and especially Greece and the Levant, may be more particularly singled out as fig-producing districts. Botanists class the fig-tree (*Ficus Carica*) with the natural order *Moraceæ* (or with the *Urticaceæ*), and it is allied to the mulberry and the bread-fruit. The tree is a deciduous plant, growing to a height of 15 to 30 feet, and bearing dark-green foliage. Its flowers are very small and inconspicuous; they are borne inside the hollow, pear-shaped receptacle which constitutes the edible “fig”, and which is commonly referred to as the “fruit”. Strictly, however, the fig which we eat is only a fleshy enlargement of the stalk: the true “fruits” are inside this, and enclose the seeds. In warm climates two crops of figs per annum are obtained—“summer figs” or “firsts”, and “autumn figs” or “seconds”. Occasionally a third and much poorer crop is yielded towards the end of the year; but the autumn gathering is the one which, in warm climates, gives the most figs, and the best suited for drying. The summer “fruit” is more watery and not so sweet as the autumn kinds, and is generally eaten in the fresh state. Where the climate is colder only “summer” figs are usually obtained, unless the autumn happens to be exceptionally warm. These figs commence to form during the previous season, but the temperature being insufficient to ripen them they lie dormant through the winter, resume their growth in the following spring, and ripen about June.

In gathering the crops the figs are either hand-picked (Turkish *elémé*) or shaken from the trees into sheets. Since figs contain a large quantity of sugar, they can be preserved by simply drying them in the sun. This is done by spreading them on wicker trays and exposing them during the day-time; at night,

Gathering
the Fig.

if the climate is dry, they are simply covered over with a cloth; otherwise they are removed to a dry room. In Southern Europe figs are commonly "cured" by sulphuring—*i.e.* by exposing them to the fumes of burning sulphur—as well as by being sun-dried. When they can be flattened without splitting they are sufficiently dry, and this point is reached when the figs have lost about two-thirds of their original weight. In other districts the fruit, when gathered, is dipped for a minute or two into a hot lye of wood-ashes (potashes), then in water to wash off the alkali, after which they are drained and dried, either in the sun or in ovens. The sulphuring and the dipping in the hot lye are for the purpose of sterilizing the outside of the fruit—*i.e.* destroying spores of moulds and larvæ of insects, which might otherwise develop and spoil the fruit. When sufficiently dry the figs are gently flattened and packed in boxes with laurel leaves, or in casks, or are strung on threads or fibres: the best figs are packed in the first way. The inside of the fruit is then full of thick syrup, and sugar crystallizes on the outside. The sugar is of course the preservative agent, and it may keep the figs good for years.

The introduction and successful cultivation of the Smyrna fig in the United States was in effect an entomological problem, the history of which is well told by Dr. L. O. Howard in *Marrying the Year-Book of the United States Department of Agriculture for 1900*. Marrying
the Figs. The Smyrna fig, the standard fig of commerce, owes its peculiar flavour to the number of ripe seeds which it contains, but these ripe seeds can only be obtained by the fertilization of the flowers of the Smyrna fig with pollen derived from the wild fig, or caprifig. From time immemorial it has been the custom of the natives in Oriental regions to break off the fruits of the caprifigs, bring them to the edible fig-trees, and tie them to the limbs. From the caprifigs thus brought in, there issues a minute insect, known as *Blastophaga grossorum*, which, covered with pollen, crawls into the flower receptacles of the edible fig, fertilizes them with the pollen, and thus produces a crop of seeds and brings about the subsequent ripening of the fruit. Careful investigations have shown that the varieties of the wild fig, or caprifig, are the only ones which contain male flowers, whilst the varieties of the Smyrna fig are exclusively female. The introduction of caprifigs into California, the carrying of the insects through the winter, and the

caprification, as the process is termed, of the Smyrna figs, have all been successfully accomplished. The object in view is, in the first place, to supply the domestic demand for Smyrna figs, which is now met by imports; and, in the second place, to establish an export trade in this product. The United States will then compete in the dried fig trade with the Mediterranean countries in the open markets of the world.

Elémé figs come from Smyrna about the end of August. They are a choice quality of Turkish fig—in fact the best imported. Cheaper kinds of Turkey figs are known commercially as “**Naturals**”; these figs are allowed to dry in their proper shape without flattening. **Layered figs** are a staple Turkish article. Spanish figs are imported to a considerable extent from **Malaga** and **Valencia**; they are often packed in mats. **Greek figs** are generally smaller than the Turkish, threaded on strings, and packed in baskets or barrels. **Comadras** are a low-priced sort; as are also *Faro taps*, a well-known import. The broad commercial division of figs is into the two classes, **Dessert figs** and **cooking figs**, the former including the higher-priced varieties of pulled figs and layers, the latter the cheaper articles. Figs are also preserved in syrup, and as *glacé* fruit (gold figs).

(6) **PLUMS AND PRUNES.**—The chief imported varieties of this fruit are classed as *Bosnian*, *Californian*, *French Imperials*, and *Prunes*. There is no essential difference between dried plums and prunes; a prune is a dried plum of a more or less particular character, but the two classes merge into each other in trade usage. It is true that there is a well-defined class of the plum tribe recognized by horticulturists as “*Prunes*”; but the commercial prunes are not by any means confined to this class. Authorities divide the plums (genus *Prunes*; order *Rosaceæ*) into Nectarine-plums, Gages, Orleans Plums, Apricot-plums, Prunes, Imperials, Perdrigons, and Mirabelles, the differences depending upon the shape and colour of the fruit and the character of the shoots. A recognized synopsis may be summarized and shown thus:—

I.—Fruit round.

A.—*Summer shoots smooth.* 1. Skin dark.—Nectarines. 2. Skin pale.—Gages.

B.—*Summer shoots downy.* 1. Skin dark.—Orleans. 2. Skin pale.—Apricots (*i.e.* Apricot-plums, not ordinary apricots).

II.—Fruit oval.

A.—*Summer shoots smooth.* 1. Skin dark.—Prunes. 2. Skin pale.—Imperials.

B.—*Summer shoots downy.* 1. Skin dark.—Perdrigons. 2. Skin pale.—Mirabelles.

Each of these varieties is divided into two kinds, "Free" and "Cling", according as the flesh separates from the stone or adheres to it. Thus there are free-gages and cling-gages, free-Imperials and cling-Imperials, and so on. The various individual sorts which are usually given fancy names, such as "St. Julian", "Impératrice", and so on, belong to the free or cling varieties of one or other of the foregoing eight classes of fruit.

French Imperials are perhaps the most celebrated of all the plums. They are cultivated extensively in the Loire district, and are shipped here from Bordeaux. One of the chief varieties is the *St. Catharine* or *Bricette* plum, one of the cling-Imperials. The fruit of this is medium to large sized, tapering towards the stalk. Its flesh is yellow, delicate, and melting, with a rich and sugary flavour; it is adherent to the stone. It is a very excellent old French plum, highly esteemed either for dessert use or for preserving or drying. The tree is a vigorous grower and a good bearer. The fruit ripens towards the middle of September; it can be dried to a prune on the tree if the latter is trained against a wall, but in the open the fruit is liable to be blown off before ready. Large-sized, dark-skinned varieties of other sorts are also included under the designation of French plums. It is said that Servian produce sometimes masquerades as French.

Prunes are dried plums of several sorts, those plums being chosen which are of firm texture, which are readily dried whole, and which are found on drying to give a satisfactory prune. In some cases the fruit may be left on the tree until it shrivels and dries to form the prune, but as a rule it is dried after gathering. The famous French prune *D'Agen*, or *Prune du Roi*, is one of the "free-prunes" of the above synopsis. The fruit of this plum is medium-sized, obovate, and somewhat flattened on one side. Skin deep purple, almost approaching black, and covered with blue bloom. Another well-known French variety is the *Petit Damas*, or *St. Julian*, grown in the Loire district.

French Dried
Plums.

French
Prunes.

Brignole, a small Provençal town, is noted for its prunes, and is the centre of a considerable trade. Its specialty is the White and the Blue Perdrigons; the two, when dried, forming the renowned "*Pruneaux de Brignole*". The White Perdrigon (*Perdrigon blanc*) is not one of the true Perdrigons; it is one of the free-Mirabelles: the Blue Perdrigon (*Perdrigon violette*; *Brignole violette*) is one of the cling-Perdrigons. The fruit of the blue variety is medium-sized, oval, widest at the apex; skin reddish-purple, marked with minute yellowish dots, and covered with thick grayish bloom. Its flesh is firm, rich, sugary, and perfumed. It is an old and excellent plum. The fruit of the White Perdrigon is very similar, but its colour is pale yellow with white dots.

Until recently France possessed the monopoly of producing the best qualities of dried plums, and though Bosnia and California now successfully dispute this with her, the annual value of the plums prepared in the district of Agen (the chief town of the Department of the Lot and Garonne) amounts to 20,000,000 francs. Plums are also produced in Touraine, Lorraine, and several departments of the Rhone Valley, but these are not so highly appreciated. The plum we have already mentioned as *prune d'Agen*, is also called, in reference to the manner of grafting used by the growers, *prune d'ente*. It must have acquired its full ripeness before being used for drying, and is frequently gathered from the ground after falling of itself, the theory held by some growers being that prepared in this state it keeps better, has a superior flavour, weight, and bulk, and turns out blacker. To prevent damage from falling on hard ground and soiling through dirt, a layer of straw is spread under the trees.

THE DRYING PROCESS.—Two processes are used for drying the plums, the old French one, which is very tedious and laborious, and the American evaporating system. In the former method the plums, after being gathered, are spread out on beds of straw or rushes, and are exposed to the sun for one or two days, during which they are turned several times. The smaller farmers put them in their local bakers' ovens, but the larger growers have a special steaming-apparatus. After each baking the plums are exposed to the air and turned over. During the first baking the temperature must not exceed 45° to 50° C.,

during the second 65° to 70° C., and during the third 80° to 90° C., otherwise the skins break and the plums burn. Each baking lasts six hours. The fruit is considered good when the skin is firm and shining and the flesh elastic under pressure of the fingers. During the first and second bakings all air crevices are stopped, so that the plums are constantly in an atmosphere saturated with steam. During the third baking, however, the apertures are left open. But in the evaporating process the plum is lighter, and the taste quite equal to the fresh article, and, as this method is quicker, it is less costly. It consists of exposing the fruit in a hot-air current, the temperature of which must not reach 100° C., so that they are not boiled, which would spoil the taste. After gathering they are laid on wicker trays and put in the evaporator, where they remain from twelve to fifteen hours. After being taken out and cooled they are piled up in lofty chambers, where they remain from ten to fourteen days. The moisture is very unequal, as some fruits contain more water than others, and this last process levels them up. A ripe plum of good quality contains on an average 75 per cent of water, the remaining 25 per cent being flesh and stone. After drying it has lost 80 per cent to 90 per cent of its weight of water, the remaining 20 per cent or 10 per cent of moisture giving the plum the soft and elastic qualities which a good dried plum should possess.

The French plums are classed according to the number it takes to weigh a French pound. The largest plums take 40 to 44 to the pound, and fetch the highest price; and the sizes then following take 50 to 54, 60 to 64, and so on up to 120 to 124 to the pound, which fetch a very inferior price.

Old French plums can be made to look almost like new by steaming them in a sieve over a hot copper, dipping them in syrup, and drying them in the sun or near a fire. A grocer writes:

"Take an ordinary fruit-sieve and fill it with prunes, adding about 1 lb. of Barbados or Demerara syrup. Place it over a copper of boiling water with the lid on the top of the sieve. Allow it to remain half an hour. If the prunes are sound, and have been well cured, the result is highly satisfactory; in fact, it would take a good judge to tell them from new fruit. We have just treated a quantity of two-year-old very 'rusty' Bosnians in this manner."

The export of prunes from the United States is now extremely large.

The Californian prune crop, which forms the bulk of the output, was about $55\frac{1}{4}$ million pounds in 1896, and now it probably exceeds 130 million pounds.

The dried plums or prunes reach this country packed in boxes of various sizes, and the finest rank next after the French Imperials in price, though considerably lower, as a rule.

Germany raises and prepares a considerable quantity of prunes. One of the chief kinds is the *Quetsche* Plum, or *German Prune*, which, like the D'Agen, is one of the "free-prunes". Another well-known European variety is the *Fellenberg* or *Italian Prune*. This also is one of the "free-prunes", though its shape inclines to the round rather than to the typical oval of its class. It is a rich-flavoured fruit.

Plums and prunes are produced also in Spain and Portugal. A large-sized variety grown in the former country is known as "Porcal" plums.

Bosnian Plums come not only from Bosnia but from the neighbouring countries, *e.g.* Herzegovina and Servia. The chief emporium for the fruit is Breka, a town on the Save, whence considerable quantities of the dried plums and prunes are despatched. The plums are dried in ovens and sorted by sieves into various sizes.

Bosnian and Californian Plums.

Dried prunes are usually exported from Servia in sacks, but a considerable proportion of the better qualities are sent abroad packed in boxes of $12\frac{1}{2}$ or of 25 kilogs. The foreign merchants importing the Servian fruit repack it in smaller boxes for retail sale. To export the fruit in boxes costs from 3 to 4 marks more per 100 kilogs. (1s. 6d. to 2s. 1d. per cwt.) than in sacks, and only pays when the French crop has been bad. The plum-orchards of Servia are situated in the districts lying along the banks of the Save, and to the west of the railway between Belgrade and Nisch. The principal towns in which the plums are collected for sale are Belgrade, Obrenovatz, Schabatz, Waljevo, Uzitze, Pozega, Ivanitza, Cacak, Arendjelovatz, Kragujevatz (the principal place exporting plum jam), Jagodina, and Krushevatz, the three first-named towns being the principal places for the export of dried prunes. In these districts the land is unsuited for the cultivation of cereals, and the prosperity of the rural population is entirely dependent

Servian Plum-growing.

on the plum crop. At harvest-time large numbers of Polish Jews, bringing their boiling apparatus, utensils, casks, &c., with them, migrate into the plum-growing districts and buy up the plums which are not used for drying, which they boil down and export as jam known as "pekmeo", "lequar", or "lekvar".

(7) RAISINS.—Raisins are grapes which have been dried, either in the sun or otherwise, the preservative agent being the sugar which they contain. There are many different kinds of grapes used for the production of raisins, all of them, however, being varieties of the common grape-vine, *Vitis vinifera*, belonging to the botanical order *Vitaceæ*. The vine is essentially a plant belonging to the sub-tropical and warm-temperate zones. It is indigenous to the country lying south of the Caspian Sea. Whilst the grape will flourish in almost any soil that is not too wet—sandy, calcareous, loamy, or light clay,—yet for its successful cultivation the climate must be one with plenty of light and sunshine, the air must be tolerably dry, the rainfall not too great, and the temperature not too low, or the grape will be deficient in sugar. Practically its profitable cultivation, whether for raisins or for wine, cannot as a rule be carried on in Europe, except between the 30th and 50th parallels of latitude; and it is within these limits that the chief vine-growing countries lie. The principal raisin-producing regions in the Old World are the south of Spain, Greece, Turkey, Italy, Southern France, and Persia. Large quantities of the fruit are also raised in California, and the industry has been practised, with more or less success, in Australia and at the Cape. The grapes used for raisin-making are those which contain plenty of pulpy tissue and grape sugar. Two principal methods of preparing the fruit may be mentioned, but there are several more or less important modifications.

(i) DRYING ON THE VINES.—This is the method used in the Malaga district, where Muscatel grapes are chiefly dried. When the grapes are ripe most of the leaves How Raisins are Prepared. are pulled off the vine to allow of the full heat of the sun reaching the fruit. Then the stem of each bunch is cut half through, or partly broken by wrenching, so as to check the flow of sap to the grapes; and the latter are then simply allowed to dry in the sun—an operation which requires some two or three weeks. The raisins prepared in this way are considered very superior.

(ii) DRYING AFTER CUTTING.—This is a quicker process than that just described, and is largely used, especially where the weather is not to be depended upon to be warm and dry for the length of time required by the first method. When the grapes are ripe the stem of the bunch is twisted or cut and the leaves thinned from the vine as before, in order to allow the moisture in the grapes to evaporate. After a time the bunches are cut off and spread on wicker trays to dry in the sun for a day. They are next dipped into a boiling lye of wood-ashes and salt, containing a little lavender or rosemary, and on which floats a layer of olive-oil, until the grapes are slightly wrinkled. As the fruit is withdrawn from the liquor a thin film of oil adheres to its surface and gives it a brighter and more glossy appearance. The dipped grapes are then spread on the wicker trays and exposed in the sun for three or four days, when they are packed in boxes.

This rapid method of raisin-curing is employed in the Denia district, in Southern Spain, and it enables the Denia raisins to be put on the market somewhat earlier than those from Malaga.

The principal varieties of raisins comprise the following:—

Muscateles.—These come mostly from the Malaga and Valencia districts, and are looked upon as the finest quality. The best are dried on the vine as above described, and the first qualities are usually fine sound raisins of large size, since the small and damaged fruit is trimmed off the bunches before packing. The Denia Muscateles are less valued than those from Malaga. Muscateles are packed in layers ("layer raisins") between sheets of paper in boxes, and flattened partly by hand and partly by the pressure of the boxes, which are placed one on the top of another before being fastened up. Fine Dehesa qualities are much esteemed, and fetch some of the highest prices.

Other kinds which come from the Malaga district, and which are sometimes classed with Muscateles under the general designation of "Malaga" raisins, are *Bloom Raisins* and *Lexia Raisins*. The former are prepared like Muscateles (whence they are sometimes called "Sun Raisins"), but the grape from which they are obtained has a bluish "bloom" on its soft glaucous surface. The Lexias, which are also grown in the Valencia district, are

cured by the second method above described, viz. by dipping into a hot lye of potashes and subsequently drying.

Valencias.—These come mainly from the province of the same name, and are a favourite article, of medium and low price; **Denias** may be classed with them as regards price. These raisins are cured by the rapid “dipping and drying” process. A seedless variety of Valencias is also imported. The new season’s crop of Valencias usually begins to arrive here in August. At a public auction in London in October, 1902, thirty-one $\frac{1}{8}$ boxes of Valencia raisins sold at the rate of 155 shillings the cwt.

Turkey.—The raisins imported from Turkey include *Red*, *Chesmé*, and *Elémé*, and are mostly shipped from Smyrna. The *Elémé* is a light-brown raisin, of long shape, and, as the name implies, is a “hand-picked” fruit. It is used for ships’ stores.

Sultanas.—These are grown in Turkey, Greece, and Persia, the chief locality being the Smyrna district. They are obtained from a seedless variety of grape. The vines come into bearing in the fifth year, and remain productive for sixty years or more. Sultanas are generally cured by a method essentially similar to the second of the two processes described above, the product being the well-known small, sweet, golden-yellow raisin, with a delicate skin. The fruit is classed commercially as **Greek**, **Smyrna** or **Turkey**, and **Persian**, and the new growths usually arrive in this country towards the third week in August. The quality of the Greek Sultana is bringing it much into favour in the markets of the United Kingdom; in berry it is somewhat smaller than the choicest Smyrna fruit, but brighter and yellower.

Californian Raisins.—Up to 1890 the United States imported large quantities of raisins and grapes, but now exports considerable amounts of both. This is due to the establishment of the raisin-grape industry in California, which is taking a leading place among fruit-producing regions.

In preparing raisins for retail sale it is not necessary to damp them; but some think they are improved by a dry rub with the hand, as this fetches off the grit, and makes them look brighter. For Christmas, raisins may be sold “ready stoned” by using an American machine called a “raisin seeder”; the best form, however, is expensive.

(8) CANDIED PEEL may also be conveniently described here.

Citron, Lemon, Orange, and Mixed Peel are the kinds usually sold as *Candied peels*, the citron being the most valuable. A good deal is prepared in this country, but considerable quantities are imported from the Mediterranean. The process followed at Leghorn for the manufacture of citron peel will exemplify the general methods of preparation. The citrons are cut open and soaked for some time in brine, after which the fruit is separated by hand from the rinds. The latter are then steeped in water to dissolve out the absorbed salt, and boiled to make them tender. They are next treated with weak sugar-syrup, then with a somewhat stronger syrup, and again with one still stronger, and so on; until, after about a week or eight days, the peel has become nearly saturated with the strong syrup. To complete the operation the partly-saccharified peel is now boiled with a concentrated sugar-solution of the thickness of treacle, and drained on wire-netting. It is by this time completely saturated, and on repeating the boiling and drying, the excess of sugar on the peel crystallizes as it cools on the surface of the rinds, producing the well-known candied appearance. The peel is now ready to be packed.

In spite of the trouble involved in candying, the candied peel is only about one-fourth of the price of the simple dried orange peel used in pharmacy. This is because of the great increase in weight, due to the water and sugar, in the candied article as compared with the dried peel.

SALTED PEEL.—At Syracuse the industry of salting peel, both of the bitter orange and lemon, is practised. The fruit is cut into halves and packed in casks, to each of which is added 28 kilogs. of salt and sea-water. The fruit is then left for some days to ferment, and when the fermentation is completed the sea-water is drained off and the casks are refilled with prepared peel; sea-water is again added, and they are then ready for exportation. Each cask contains about 3000 lemons, the total weight of the cask being about 500 kilogs., though it only contains 350 kilogs. of peel, the surplus weight being salt and sea-water.

(9) **FANCY FRUITS.**—The various kinds of crystallized and candied or glacé fruits, though they may be prepared by diverse methods, all consist essentially of fruit which in one way or another has been treated with sugar. A considerable quantity

is produced in this country, but for the most part it is imported, France, Germany, and Portugal being the three chief countries which send us fancy fruits. The Metz pre-^{Sugared Fruits.}parations have gained a reputation for superior quality. The chief varieties of crystallized and glacé fruits now met with are the following:—

Angelica, Apricots, Brochettes, Cherries, Chinois (gold), Chinois (green), Figs, Greengages, Knots (mixed), Lunettes, Metz Fruits, Mirabelles, Mixed Fruits, Peaches, Pears, Pine-apple (slices and cubes), Roses, Raspberries, Strawberries, and Violets. Crystallized ginger may also be mentioned; it occurs as ginger glacé or crystallized, stem-glacé ginger, chips, and candy. "Imitation" crystallized fruits, such as Orange and Lemon Slices, are also imported.

One method of obtaining those preparations in which the form and character of the fruit are preserved is as follows:—The fruit, which is preferably gathered unripe, and whilst the stone is still soft in the case of plums, greengages, &c., is boiled until it has become tender, and is then suspended in strong syrup. In this it is allowed to hang until it has become practically transparent, the syrup being maintained at its full strength during the process by occasional evaporation to keep it saturated with sugar. When the fruit has become sufficiently permeated with the syrup it is removed, and either dried in a current of warm air or placed in a stove at a temperature not exceeding 120° F. until the syrup has crystallized.

The manufacture of sugared fruits in Portugal was formerly in the hands of the nuns, but is now largely carried on by ordinary commercial firms. Apricots, peaches, plums, and figs are the Portuguese specialties, and the process employed consists essentially in repeatedly boiling the unripe fruit in syrup. When the operation is finished the excess of syrup is allowed to drain off, and the fruit is then dried on trays in the open air. For exportation it is put up in round, tastefully-decorated boxes of various sizes.

When crystallized and glacé fruits are packed and weighed before the contained syrup is dry, they are liable to lose weight through the evaporation of moisture. Retailers, however, are usually charged on the actual net weight of the fruit at the time of delivery.

DRIED FRUIT, &c., WEIGHTS.—Currants (all kinds), cases, 1 cwt. and under 1 cwt. 2 qrs.; $\frac{3}{4}$ -cases, 3 qrs. and under 1 cwt.; $\frac{1}{2}$ -cases, 2 qrs. and under $\frac{3}{4}$ cwt.; $\frac{1}{4}$ -cases, 1 qr. and under 2 qrs.; $\frac{1}{8}$ -cases, under $\frac{1}{4}$ cwt. Raisins (Valencia), $\frac{1}{2}$ -boxes, $\frac{1}{4}$ cwt.; $\frac{1}{4}$ boxes, 14 lbs.; $\frac{1}{8}$ -boxes, 7 lbs.; Elémé, cases, $\frac{1}{2}$ cwt. Sultana, cases, all wooden pkgs. of 84 lbs. gross and upwards. Other than Smyrna, $\frac{1}{2}$ -cases, 56 lbs. and under 84 lbs. gross; $\frac{1}{4}$ -cases, 28 lbs. and under 56 lbs.; $\frac{1}{8}$ -cases, under 28 lbs. gross. Persian packages (various), from 1 to 2 cwts. Boxes of Smyrna Raisins weigh from 28 lbs. to 35 lbs. gross, unless specially stipulated or actual packages shown. Raisins (Muscatel), boxes, 22 lbs.; $\frac{1}{2}$ -boxes, 11 lbs.; $\frac{1}{4}$ -boxes, 5½ lbs.; trays, 5 lbs. Figs (Turkey), skeleton cases, 2½ to 3 cwts.; natural cases, $\frac{1}{2}$ cwt.; boxes, $\frac{1}{4}$ lb. to 14 lbs.; bags, 14 lbs. to 60 lbs.; larger bags, 1 to 2 cwts. Faro, tapnets, 28 lbs.; boxes, 22 lbs. Prunes and Plums, cases, $\frac{1}{2}$ and $\frac{1}{4}$ cwt. Bosnian Plums, $\frac{1}{2}$ -cases, $\frac{1}{2}$ cwt. Dates, Bussora, &c., mats and skins, 1 cwt.; cases, $\frac{1}{2}$ cwt.; $\frac{1}{2}$ -cases, 28 lbs. Almonds (Jordan), boxes, 25 lbs. Valencia and Messina, $\frac{1}{2}$ -boxes, 28 lbs. Sicily, Bari, &c., bales, Sweet and Bitter, 1¾ to 2 lbs.; boxes, Sweet, 28 lbs. Barbary, packages, Sweet and Bitter, 2 cwts. Shell, bales, 2 cwts.

II. SUGARS

Sugar, in these days of cheapness, can hardly be an article yielding very much profit to the grocer. When goods which formerly fetched 4*d.* to 6*d.* per lb. have come down to 2*d.* or less, the margin for remunerative dealing is necessarily reduced. But, whether the profit be little or much, the grocer must still stock "cubes" and "loaf", "crystals" and "caster"; and this chapter is written with the view of describing the production and the chief characteristics of the various kinds of sugar which he is likely to be called upon to handle.

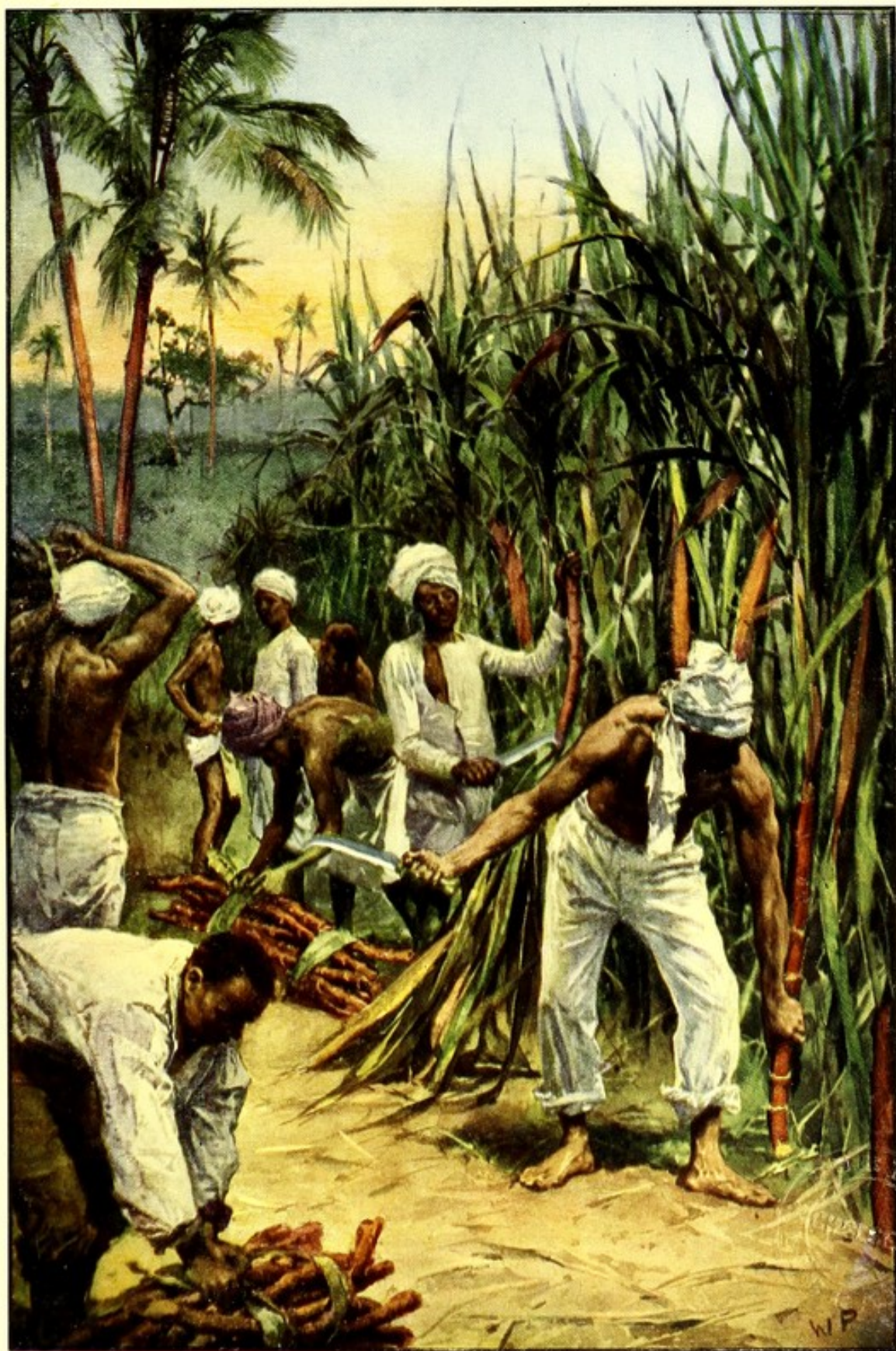
Commercial sugars may be grouped into two great divisions:—

(i) Those corresponding to sugar derived from the sugar-cane. These furnish, almost exclusively, the various kinds of sugar used for domestic purposes.

CUTTING THE SUGAR-CANE

One effect, it is hoped, of the abolition of bounties by most of the beet-sugar producing nations—an international reform which began to take marked effect in 1904—will be to restore fair-play to the industry of making sugar from the sugar-cane. Although in the opinion of many an immeasurably superior article for ordinary sweetening purposes, cane-sugar has been so largely displaced from its market by beet that of late years the industry has languished, and the sugar-cane has not supplied a third part of the world's annual consumption of sugar. Doubtless we may now expect a great improvement. The largest individual producer of cane-sugar in recent years is Java, and the next Cuba, but Demerara, the Lesser Antilles, Barbados, and other British Colonies are very large producers. Our illustration shows how the sugar-cane grows in the West Indies, and how it is cut by the coolies.

Deer, Fawn, Antelope, Caribou—Curtains (all kinds), cases, 1 cwt. and under 1 cwt.; 1/2-cases, 3 qrs. and under 1 cwt.; 1/4-cases, 1 qr. and under 1/4 cwt.; 1/8-cases, 1/8 cwt. Raisins (Valencia), 1/2-cases, 14 lbs.; 1/4-cases, 7 lbs.; Elémé, cases, 1/2 cwt. Raisins, cases, all wooden pkgs. of 34 lbs. gross and under 34 lbs.; 1/4-cases, 50 lbs. and under 50 lbs.; 1/8-cases, 25 lbs. and under 25 lbs.; 1/16-cases, 12 lbs. and under 12 lbs.; 1/32-cases, 6 lbs. and under 6 lbs.; 1/64-cases, 3 lbs. and under 3 lbs.; 1/128-cases, 1 lb. and under 1 lb.; 1/256-cases, 1/2 lb. and under 1/2 lb.; 1/512-cases, 1/4 lb. and under 1/4 lb.; 1/1024-cases, 1/8 lb. and under 1/8 lb.; 1/2048-cases, 1/16 lb. and under 1/16 lb.; 1/4096-cases, 1/32 lb. and under 1/32 lb.; 1/8192-cases, 1/64 lb. and under 1/64 lb.; 1/16384-cases, 1/128 lb. and under 1/128 lb.; 1/32768-cases, 1/256 lb. and under 1/256 lb.; 1/65536-cases, 1/512 lb. and under 1/512 lb.; 1/131072-cases, 1/1024 lb. and under 1/1024 lb.; 1/262144-cases, 1/2048 lb. and under 1/2048 lb.; 1/524288-cases, 1/4096 lb. and under 1/4096 lb.; 1/1048576-cases, 1/8192 lb. and under 1/8192 lb.; 1/2097152-cases, 1/16384 lb. and under 1/16384 lb.; 1/4194304-cases, 1/32768 lb. and under 1/32768 lb.; 1/8388608-cases, 1/65536 lb. and under 1/65536 lb.; 1/16777216-cases, 1/131072 lb. and under 1/131072 lb.; 1/33554432-cases, 1/262144 lb. and under 1/262144 lb.; 1/67108864-cases, 1/524288 lb. and under 1/524288 lb.; 1/134217728-cases, 1/1048576 lb. and under 1/1048576 lb.; 1/268435456-cases, 1/2097152 lb. and under 1/2097152 lb.; 1/536870912-cases, 1/4194304 lb. and under 1/4194304 lb.; 1/1073741824-cases, 1/8388608 lb. and under 1/8388608 lb.; 1/2147483648-cases, 1/16777216 lb. and under 1/16777216 lb.; 1/4294967296-cases, 1/33554432 lb. and under 1/33554432 lb.; 1/8589934592-cases, 1/67108864 lb. and under 1/67108864 lb.; 1/17179869184-cases, 1/134217728 lb. and under 1/134217728 lb.; 1/34359738368-cases, 1/268435456 lb. and under 1/268435456 lb.; 1/68719476736-cases, 1/536870912 lb. and under 1/536870912 lb.; 1/137438953472-cases, 1/1073741824 lb. and under 1/1073741824 lb.; 1/274877906944-cases, 1/2147483648 lb. and under 1/2147483648 lb.; 1/549755813888-cases, 1/4294967296 lb. and under 1/4294967296 lb.; 1/1099511627776-cases, 1/8589934592 lb. and under 1/8589934592 lb.; 1/2199023255552-cases, 1/17179869184 lb. and under 1/17179869184 lb.; 1/4398046511104-cases, 1/34359738368 lb. and under 1/34359738368 lb.; 1/8796093022208-cases, 1/68719476736 lb. and under 1/68719476736 lb.; 1/17592186044416-cases, 1/137438953472 lb. and under 1/137438953472 lb.; 1/35184372088832-cases, 1/274877906944 lb. and under 1/274877906944 lb.; 1/70368744177664-cases, 1/549755813888 lb. and under 1/549755813888 lb.; 1/140737488355328-cases, 1/1099511627776 lb. and under 1/1099511627776 lb.; 1/281474976710656-cases, 1/2199023255552 lb. and under 1/2199023255552 lb.; 1/562949953421312-cases, 1/4398046511104 lb. and under 1/4398046511104 lb.; 1/1125899906842624-cases, 1/8796093022208 lb. and under 1/8796093022208 lb.; 1/2251799813685248-cases, 1/17592186044416 lb. and under 1/17592186044416 lb.; 1/4503599627370496-cases, 1/35184372088832 lb. and under 1/35184372088832 lb.; 1/9007199254740992-cases, 1/70368744177664 lb. and under 1/70368744177664 lb.; 1/18014398509481984-cases, 1/140737488355328 lb. and under 1/140737488355328 lb.; 1/36028797018963968-cases, 1/281474976710656 lb. and under 1/281474976710656 lb.; 1/72057594037927936-cases, 1/562949953421312 lb. and under 1/562949953421312 lb.; 1/144115188075855872-cases, 1/1125899906842624 lb. and under 1/1125899906842624 lb.; 1/288230376151711744-cases, 1/2251799813685248 lb. and under 1/2251799813685248 lb.; 1/576460752303423488-cases, 1/4503599627370496 lb. and under 1/4503599627370496 lb.; 1/1152921504606846976-cases, 1/9007199254740992 lb. and under 1/9007199254740992 lb.; 1/2305843009213693952-cases, 1/18014398509481984 lb. and under 1/18014398509481984 lb.; 1/4611686018427387904-cases, 1/36028797018963968 lb. and under 1/36028797018963968 lb.; 1/9223372036854775808-cases, 1/72057594037927936 lb. and under 1/72057594037927936 lb.; 1/18446744073709551616-cases, 1/144115188075855872 lb. and under 1/144115188075855872 lb.; 1/36893488147419103232-cases, 1/288230376151711744 lb. and under 1/288230376151711744 lb.; 1/73786976294838206464-cases, 1/576460752303423488 lb. and under 1/576460752303423488 lb.; 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COOLIES CUTTING SUGAR-CANE, WEST INDIES



(ii) Those corresponding to glucose or grape sugar. These are chiefly used in manufactures.

The first group are known as the cane sugars or "sucroses", but they are not all derived from the sugar-cane. *Maple sugar*, *beet sugar*, *jaggery*, and *sorghum* are all included in the group, because these sugars when *chemically* pure—which most of them never are, in commerce—are absolutely identical with the product obtained from the cane. It should be noted, therefore, that the term "cane sugar" may, unfortunately, be used in two senses; but here it will be employed to denote only the actual product of the sugar-cane, unless the context clearly indicates otherwise.

CANE SUGAR.—The sugar-cane (*Saccharum officinarum*) is cultivated chiefly in India, the East and West Indian Islands, Mauritius, Brazil, and Peru; and to a smaller extent in Egypt, China, and Australia. There are many varieties, some of the most important being the common yellow "Creole" cane, the purple cane, and the gigantic Indian light-coloured cane called "karambou valli". The height of the stem is on an average about 10 feet, but it may be as much as 16 or 18. The stem is 1½ to 2 inches thick, jointed at short intervals, and with leaves springing from the joints. The interior of the stem contains a soft pith, in which flows the sweet juice from which the sugar is extracted. About twelve to sixteen months are required for the canes to ripen. They are then cut down, stripped of their leaves, and crushed between rollers to extract the juice. The latter is heated, and lime or sulphite of lime

How Cane
Sugar is
made.

added, whereby fermentation is prevented, and a quantity of impurities caused to come to the surface as a scum. This being skimmed off, the partly-clarified juice is evaporated in copper pans until of a syrupy consistence, when it is run into a shallow "cooler" and allowed to crystallize. A part of the syrup is uncrystallizable, and remains as a thick liquid surrounding the sugar crystals; this liquid is "molasses". It is drained from the sugar more or less roughly, and the residual crystals are imported into this country chiefly as raw sugar, being known here as, for instance, West India crystals, and coming into the market as "fine", "good", and "inferior", "syrops and dabs", "grainy syrops", and so on. The next step is the refining of this raw product. There are numerous processes, but an outline of one will suffice to show the nature

of the operations, which do not differ materially in principle, whether the sugar is cane or beet.

The raw product is sometimes subjected to preliminary treatment by the "Weinrich" process. This consists essentially in washing the crystals of raw sugar with steam in a centrifugal machine, by which means the impurities adherent to the crystals are removed. The yield with good, large-grained sugar is as much as 80 to 90 per cent of purified crystals, polarizing over 99 degrees. The washings pass out of the machine as a thin syrup, from which low-quality sugar is obtained by boiling down.

In the ordinary refining process the raw sugar is dissolved in about half its weight of hot water, and then filtered from suspended impurities. The brown liquor is run into large iron cylinders containing animal charcoal ("char" or "bone black"), which decolorizes it and removes any gummy matter. As long as the liquor comes through colourless it is collected for making white sugar; but when it becomes yellowish, from the exhaustion of the charcoal, it is diverted into another tank and used for the production of a lower grade of sugar. Sulphurous acid is also used by some refiners for decolorizing purposes.

Next comes the concentrating of the syrup, which is effected in a vacuum-pan. This is simply a vessel which can be closed so that the air and vapour can be exhausted: the greater the exhaustion the lower the temperature required to boil off the water from the syrup. The pan is heated by steam. When sufficiently concentrated, the syrup begins to deposit crystals of sugar. The mixture of crystals and syrup at this stage is called "massecuite", and either large- or small-grained sugar is obtained, according to the way in which the process is conducted at this point.

Large Crystals.—To get large-grained sugar, small crystals are first placed in the pan, and the latter is only partly filled with syrup, in order not to dissolve the crystals. This liquor is evaporated in a partial vacuum, then more liquor run in and again boiled. The sugar from the syrup deposits upon the surface of the crystals left in the pan, and thus increases their size. This operation (termed "cutting") is repeated several times, larger and larger crystals being yielded each time.

Small Crystals.—For soft sugar or "pieces", a larger quantity of syrup is introduced into the pan to commence with, and this

being boiled down to the crystallizing point under smaller pressure yields a greater number of small crystals. Less time is taken in the boiling, and the massecuite is of smaller grain.

In either case, the massecuite is next passed to the centrifugal machine, where it is freed from syrup and dried by rapid whirling. At this stage the refiner sprinkles on the sugar a little ultramarine or indigo dissolved in water, in order to improve the whiteness of the sugar—about a tea-spoonful to a ton of sugar.

Loaf Sugar.—A liquor of good quality is used for this. It is boiled down, as just described, to a fine-grained thick massecuite, which, after being heated to about 180° F., is run into moulds. Until recent years the mould was in the form of a cone, producing the "titlers" which had to be chopped up with great trouble in the grocer's shop. These cones are now seldom seen.

Moulded Cubes.—The old-fashioned cone moulds for loaf sugar have been superseded by machines invented for producing moulded sugar in other ways. Two main methods may be mentioned: in one of these the sugar is moulded in slabs or sticks direct from a massecuite; in the other, soft white sugar that has been dried and purified in a centrifugal machine is formed into cubes or sticks by pressure. Most of the hard sugar used in the United States is made by the Hersey cube machine or similar apparatus. In this, white moist sugar is fed into a hopper, mixed with a small quantity of liquor just sufficient to bind the grains together, and then delivered from the hopper on to a revolving drum. Round the periphery of this drum are rows of moulds, each of the size of the cubes required. As it passes from the hopper, the sugar is pressed into these moulds, and it is afterwards, as the drum revolves, forced out on to plates ready for drying in stoves.

Granulated Sugar.—For drying and granulating sugar an important process (Hersey's) is largely used in both Europe and America. Imagine a large sheet-iron cylinder, about 8 yards long and 2 in diameter, placed in a slightly-sloping position and kept in rotation. Imagine also a closed steel cylinder of half the diameter and nearly the same length placed inside the first one and turning with it on the same axis. Then the granulating operation consists in this: the inner cylinder being kept hot with internal steam, the wet sugar is fed continuously on to the top of

it at the upper end. As the apparatus revolves, this sugar falls off into the outer cylinder, to be again carried up and once more to fall on the hot inner cylinder, and so on. The slope of the machine causes the sugar to gradually work down to the lower end and so out. Meanwhile a current of cold air is entering by this lower end and passing out at the upper; it meets the hot, moist, spread-out sugar on its way, and carries off the moisture from it. As the sugar gets gradually dried it granulates, and passes out clear, white, dry, and cool enough to be immediately barrelled.

Sugar-canes contain approximately 18 per cent of sugar, but commonly only about one-half of this is obtained as raw sugar. The other half is partly lost by being left in the canes after crushing, and partly remains in an altered form with the molasses.

In the cane-sugar industry great improvements have been made of late years, and labour-saving machinery is largely employed. In Trinidad, for instance, one factory has turned out as much as 150 tons per day of twenty-four hours' continuous working. It has 50 miles of railway to carry canes, electrical power plant, and so on. In Mexico immense twelve-roller mills have been introduced. In Madeira the "Naudet-Hinton" patent process is a very important development, being the application to cane-sugar manufacture of the "diffusion" process, formerly used only for beet. (See BEET SUGAR.) The cane juice passes direct from the mills to "diffusers", where it is clarified and filtered through its own megass. In this way the trouble of refining raw sugar is avoided, white sugar being made direct from the cane. At the end of their 1905 season Messrs. Hinton, of Madeira, declared the new process a complete success, and it is expected to revolutionize the industry.

WEST INDIAN cane-sugar products include the following:—

RAW WEST INDIA SUGARS.—*Syrups*, or molasses sugar—very soft and yellow, made from the runnings or molasses after the yellow crystals are made. *Foots*, damp moist; the little wet pieces of sugar at the bottom of the muscovado hogsheads, hence the name "Foots". *Muscovado*, the old-fashioned sugar, boiled in the primitive open pans, dark and footy as a rule; St. Kitts being dark and pungent, Barbados medium colour and larger grain, best Barbados lighter in colour. *Yellow Crystals*, made from cane juice after being well boiled down to a heavy syrup in vacuum pans, and the molasses expelled by centrifugal machinery; imported in 2-cwt. bags. "*Pieces*", soft sugar, brown, yellow, or white; name given to "Dabs" or imitation of the raw muscovado.

REFINED CANE SUGARS.—*White Crystals*, refined from the raw sugar into small

sparkling crystals—small size, medium, large, and extra large. *Lump*, pieces cut into small sizes about $\frac{3}{4}$ inch square. *Rainbow Cubes*, same, but tinted with various pretty and harmless colours. *Lump Dust*, the soft sugar at bottom of cases of lump. *Preserving Crushed*, about size of medium crystals but not so sparkling, for jams, syrups, &c. *Granulated*, very fine grain crystals, largely used in America for cooking and every purpose. *Caster*, finer still than granulated, sometimes called "Sifted Sugar". *Fine Caster*, a finer quality. *Icing*, or pulverized, like flour, for cakes, &c. *Sugar Candy*, for coffee, or sweets for children.

Also, "*Molasses*", the runnings from raw sugar while waiting for shipment; *Green Treacle*, the residue left from raw sugar in the process of refining; and *Golden Syrup*, the residual product of white cane sugar refining.

BET SUGAR.—The common beet (*Beta vulgaris*) was shown to contain sugar identical with that of the sugar-cane, by the French chemist Margraf, as long ago as 1747. It did not, however, come into competition with cane sugar until Napoleon's policy of making France as far as possible independent of foreign supplies led to the development of the beet cultivation in the early part of the nineteenth century. Even after 1860, English refiners confidently affirmed that beet-root could never be a dangerous rival to the sugar-cane, on account of the supposed impossibility of depriving beet sugar of the peculiar flavour attaching to the beet-root itself. But the confidence was ill-founded; difficulties once thought insuperable have been overcome, and at the present day some of the purest loaf-sugar in the market is prepared from beet-root, while the total amount of sugar prepared from beet is about double as much as that obtained from cane. Beets contain on an average about 10 per cent of sugar, though in Germany some varieties are cultivated which yield 15 to 18 per cent. The white or sugar beet (*Beta maritima*) is the chief kind employed.

The Manu-
facture of
Beet Sugar.

To extract the sugar, the beets are first cleaned and the tops removed. The juice may then be extracted from the rasped and pulped roots by pressure, but generally on the Continent what is known as the "diffusion" process is used. Beet cuttings are placed in a "diffuser" or "cell", which is then closed, and warm water is forced into it; this water takes up part of the sugar from the beet, and then passes on to another "cell" filled with fresh cuttings; then to another, and so on. A "battery" of twelve cells is usually employed, and the warm water passes through each in succession, so that when it leaves the last one it is charged with sugar. It leaves the diffuser as a dirty-brown liquid, while the

shreds of beet, *minus* their sugar, are sold for cattle food. To save the cost of transit of the roots, the beet juice is sometimes conveyed by underground pipes from surrounding districts to a central factory, where the sugar is extracted from it. One such factory at Coulommiers (Seine et Marne) is fed by about 20 miles of pipes, and produces some 3000 tons of sugar each season. For purifying the juice the next processes are "defecation" and "carbonatation". The juice is mixed with milk of lime and heated to near boiling (defecation); then carbonic-acid gas is pumped in (carbonatation): this gas combines with the lime to form chalk, which, being insoluble, is precipitated from the solution, and in subsiding carries down with it various impurities. The juice becomes bright on standing, when it is drawn off, and generally again defecated and carbonatated to still further purify it. The clear juice is next either passed through animal charcoal, or treated with sulphurous acid, and subsequently filtered through sand. It is then concentrated in vacuum-pans, again filtered through charcoal, and finally evaporated in a vacuum-pan until it forms "massecuite". The latter is then machined in a centrifugal machine, and yields the 1st crop of sugar, or "1st jet" as it is called. The syrup left from this is again boiled down and gives massecuite, which is again machined and yields "2nd jet" sugar. Similarly 3rd and 4th "jets" are obtained.

Beet Crystals.—The "1st jet" sugar is the best, but even this, on account of its disagreeable odour and taste, is unfit for direct consumption. But by washing it with water or steam in a centrifugal machine it is rendered nearly pure, and is marketed as "beet crystals".

About one-half of the total sugar in the beets is obtained in the 1st jet. One-seventh is lost in pulping, filtering, &c., and another seventh passes into the molasses; the remainder is in the 2nd and 3rd jets, and is obtained in a marketable condition from these by subsequent refining. The refining process for beet sugar is essentially similar to what has already been described in the case of cane sugar. The sugars used by British refiners are chiefly raw beet of different qualities, 75 to 88 per cent; inferior yellow French crystals, cane sugars of various qualities, syrups, Muscovado, and crystals. The refiner removes the insoluble impurities, then treats the mass so as to separate the soluble

impurities, and produce on the one hand white crystalline sugar, and on the other marketable molasses.

Beet Molasses contain about 50 per cent of sugar, but on account of their flavour are not much used for domestic purposes. They are either fermented and distilled, for conversion into spirits, or are treated in various ways for the recovery of the sugar. One of the most-used methods is what is known as the lime, baryta, or strontia treatment; this consists in adding one or other of these bases—strontia is frequently employed—to the molasses, with the sugar in which it forms an insoluble compound, strontium saccharate. The saccharate is washed with water or alcohol to remove the impure liquor, and is then decomposed into sugar and carbonate of strontia by suspending it in water and treating it with carbonic-acid gas. The sugar passes into solution, is drawn off from the precipitated carbonate, and evaporated down.

On the British market French cubes and cut-loaf arrive in one-hundredweight cases, and are bought at landing weights with foreign tares. A single barrel of Dutch or Austrian crushed sugar weighs about 2 cwts., and a barrelet ^{Sugar Weights and "Marks".} 1 cwt. Barrels of American cubes weigh 2 cwts. and above. The weight of 1000 French loaves is equal to $12\frac{1}{2}$ tons, and that of 1000 other foreign loaves varies from 9 to 14 tons. Various initials on the cases are used as "marks" of foreign refined sugars, but all such marks are subject to alteration from time to time. Wholesale dealers sometimes mark the foreign sugars they sell with the initials of their own firm.

Icing Sugar is highly-refined sugar which has been ground to a very fine, almost impalpable powder. Cane sugar is generally preferred for this, as it is stated that beet sugar is liable to change colour when strongly heated, and the goods prepared with it are not so white as when made with cane sugar.

Caster Sugar is less finely ground than icing sugar. It may be merely the sifted dust from loaf sugar, or it may be specially ground, and is either cane or beet sugar.

Coloured Sugars, as used in confectionery, are "icing" which has been artificially coloured blue, red, &c., by adding a liquid colouring-matter, such as decoction of cochineal, to the gently-melted sugar.

Jaggery or Palm Sugar.—This is a low-quality sugar produced from various species of palms (*Phœnix*, *Arenga*, *Borassus*)

in India, where it is largely consumed. It contains a large proportion of uncrystallizable "invert sugar", and consequently fetches only a low price from the refiner. An appreciable quantity was formerly imported into this country, but probably at the present time the amount landed here is relatively small. Before the great development of the beet industry jaggery was a factor of some economic importance in the trade, since it exercised an influence upon the price of raw sugar in times of scarcity.

Maple Sugar.—The sugar-maple (*Acer saccharinum*) abounds in the North American forests, and is a valuable source of sugar to the inhabitants of the Northern States and Canada. In the spring and early summer the sap is very plentiful; it is obtained by tapping the tree to the depth of about half an inch and inserting a tube. The collected sap is boiled down to the crystallizing point and strained, after which it is poured into moulds to solidify, when it is ready for use. A good maple will yield about four to six pounds of sugar each season. American maple sugar contains on an average about 83 per cent of pure saccharine matter.

Sorghum is a sugar obtained from the Chinese sugar-grass or cane (*Sorghum saccharatus*), a kind of barley. It is a native of India, and is largely used in China; whilst it is also cultivated in the United States to a somewhat limited extent.

All the foregoing sugars belong to the group of "sucroses" or "saccharoses", and are known collectively as the "cane sugars" from their principal representative, the product of the sugar-cane. Whatever sources they may have been derived from, *perfectly* pure "cane sugars" are indistinguishable from one another. The differences of colour, flavour, odour, &c., which distinguish the several varieties—as Demerara from beet sugar, for example—are due to the associated "impurities", or matters other than sugar, from which none except the most highly refined commercial sugars are ever wholly free. Pure cane sugar has the chemical formula $C_{12}H_{22}O_{11}$ —that is, its molecule is composed of 12 atoms of carbon, 22 of hydrogen, and 11 of oxygen. It melts to a clear yellow liquid at about 320° F., and at 410° F. it is converted into caramel. In common with other sugars it possesses the property, when in solution, of acting upon polarized light by what is called "rotating the plane of polarization". This sounds, perhaps, rather abstruse and scientific, but

the "polarization" of sugar is now a commonplace in the vocabulary of the wholesale market and a regular invoice term. In fact, within certain limits, the degree at which a sugar "polarizes" measures the amount of true saccharine matter which it contains, and is a main criterion of its value, though not the only one. For instance, the Customs Duties are thus defined:—

Sugar of a polarization exceeding 98 degrees	...	4s. 2d. per cwt.
" " " not exceeding 76 "	...	2s. 0d. "

—with intermediate duties for sugars of polarizations lying between these two degrees. The various kinds of raw sugars pay duties ranging between 2s. and 3s. 10d.; refined sugars as a rule pay the highest amount specified, viz. 4s. 2d.

Sugar Analysis.—Some such classification as the foregoing is necessary, because the various products contain very different amounts of pure sugar. This brings us, therefore, to the question of sugar analysis.

Two principal methods are used for determining the amount of pure sugar in a sample. For commercial purposes the chief of these is the "polarizing" method, which depends upon the optical property above referred to. To apply it, an instrument is employed looking much like a small telescope, and called a "polarimeter" or "saccharimeter" ("sugar measurer"). It is an ingenious device, and a few words will make the principle clear.

When ordinary light—daylight or lamplight—is passed through a certain kind of prism ("polarizer") with which the instrument is fitted, its properties are altered, in a way which we need not here particularize except by calling the light "polarized light". And when this light is passed through a solution of sugar, its characters are still further altered. As applied in the saccharimeter, the nature of the change is as follows. If we look through the instrument before putting in the sugar-solution, we see a disc of lavender-coloured light. Looking again after the sugar has been placed in, we see one-half of the disc red, the other violet. And the more sugar there is, the greater is the change of colour. By turning certain screws a compensating arrangement is brought into play, the effect of the sugar is neutralized, and we can reproduce the original uniform lavender tint. The more turning required, the greater was the colour to be "compensated", and

therefore the more sugar was there present. The instrument is fitted with scales showing the amount of movement, and the corresponding quantity of sugar. After a sample of sugar has been dissolved in the proper volume of water, the finding of its "degree of polarization" or "strength" is done in a few seconds by means of the saccharimeter.

One important property of the saccharimeter should be mentioned, since it distinguishes between different kinds of sugars. In order to get the required "compensation" of colour, the screw arrangement must be turned to the *right* for some sugars, but to the *left* for others. Cane sugar and invert sugar, for instance, have what are called opposite "rotations"; the former right-handed, the latter left-handed.

The second method of finding the percentage of sugar in a specimen is a much longer process, but it is applicable in cases for which the polarimeter is unsuited. It consists in boiling the liquid containing the sugar with an alkaline solution of copper sulphate. Oxide of copper is thus produced; it separates from the liquid as a red powder, which can be collected and weighed. Each grain or gram of oxide thus obtained represents a known definite weight of sugar. This is what is known as "Fehling's test"; and it is important as a means of distinguishing between various sugars. Thus glucose and invert sugar will cause the formation of the copper oxide at once, whereas cane sugar will not do so until after it has been treated with acids or otherwise acted on, as, for example, by treatment with yeast. So also milk sugar and grape sugar, though both give oxide of copper with Fehling's solution, yet yield it in different quantities, and can thus be distinguished from one another.

Milk Sugar.—Allied to the foregoing group are several other varieties of sugar, but only one of these need be mentioned here—milk sugar or "lactose". This is chiefly imported from Switzerland, in the form of hard crusts or broken-up cakes, or sometimes in small cylindrical masses on a string or stick. It is prepared from milk by first removing the fat and curd, then neutralizing the acid in the whey with powdered chalk, and evaporating the whey until the milk sugar crystallizes from it. The separated sugar is purified by dissolving it in water, treating it with animal charcoal, and recrystallizing it.

In the refined and powdered condition milk sugar is much used in pharmacy as a medium in which to give various medicines, and for making pills. It is also sold by itself as "Powdered Sugar of Milk", at a retail price of about 1s. per lb.

Owing to its cheapness sugar is nowadays but little liable to adulteration in the sense of being mixed with some foreign ingredients, at all events so far as the product finished for domestic consumption is concerned. With the ^{Sugar} Adulteration. coarse brown sugars of bygone years it was no doubt possible to mix a certain proportion of such substances as sand, but clumsy frauds of this kind are now out of date. The same may be said of starch and powdered glucose, which were occasionally met with when sugar was more expensive than now. There are, however, two forms of deception still practised to some extent. The one consists in crystallizing some of the lower qualities of "pieces" in such a manner as to cause them to contain more water (and more invert sugar) than they would otherwise hold, thus reducing their sweetening power; whilst, being of good colour as compared with raw sugar, they are naturally supposed to be of superior quality. The other form of deceit referred to is the imparting of a spurious appearance or colour to crystals of one kind in order to make them resemble another sort. The "blueing" of sugar with ultramarine has already been mentioned, but this appears to be simply a case of giving a better general appearance to the crystals, not of imitating a superior brand. Chloride of tin is also sometimes added to the sugar in the vacuum-pan in order to improve the colour; and, beyond any deception that this may lead to in the case of the sugar itself, there is the further objection that the tin salt passes into the syrup, in which its presence is by no means desirable. Further, in some cases crystals of beet sugar are directly dyed with an aniline colour in imitation of Demerara sugar, the yellow tint of which is due to a purely natural colouring ingredient obtained from the cane during the process of manufacture. It has been urged that this production of "yellow crystals" is merely a concession to popular prejudice, and that the sugar itself is intrinsically just as good as the Demerara product, so that the purchaser is not really defrauded. This may be true enough in some cases, though it does not follow that the coloured sugar is always of equal quality to Demerara. If it is sold as "yellow

crystals", well and good; if sold as Demerara, the purchaser does not get what he asks for, and to this extent is prejudiced.

(The term "Demerara Sugar" is held commercially to include sugar coming from West Indian islands as well as Demerara—*e.g.* from Barbados, St. Kitts, and Trinidad, where the sugar is made by the Demerara process from the sugar-cane.)

With a little careful practice it is not difficult to distinguish the lower qualities of beet sugar from the cane product. For

<p>Difference between Cane and Beet.</p>	<p>example, in Demerara sugar the colour is a bright yellow or straw tint, whereas beet has a much lighter tone, inclining to white. When beet crystals are</p>
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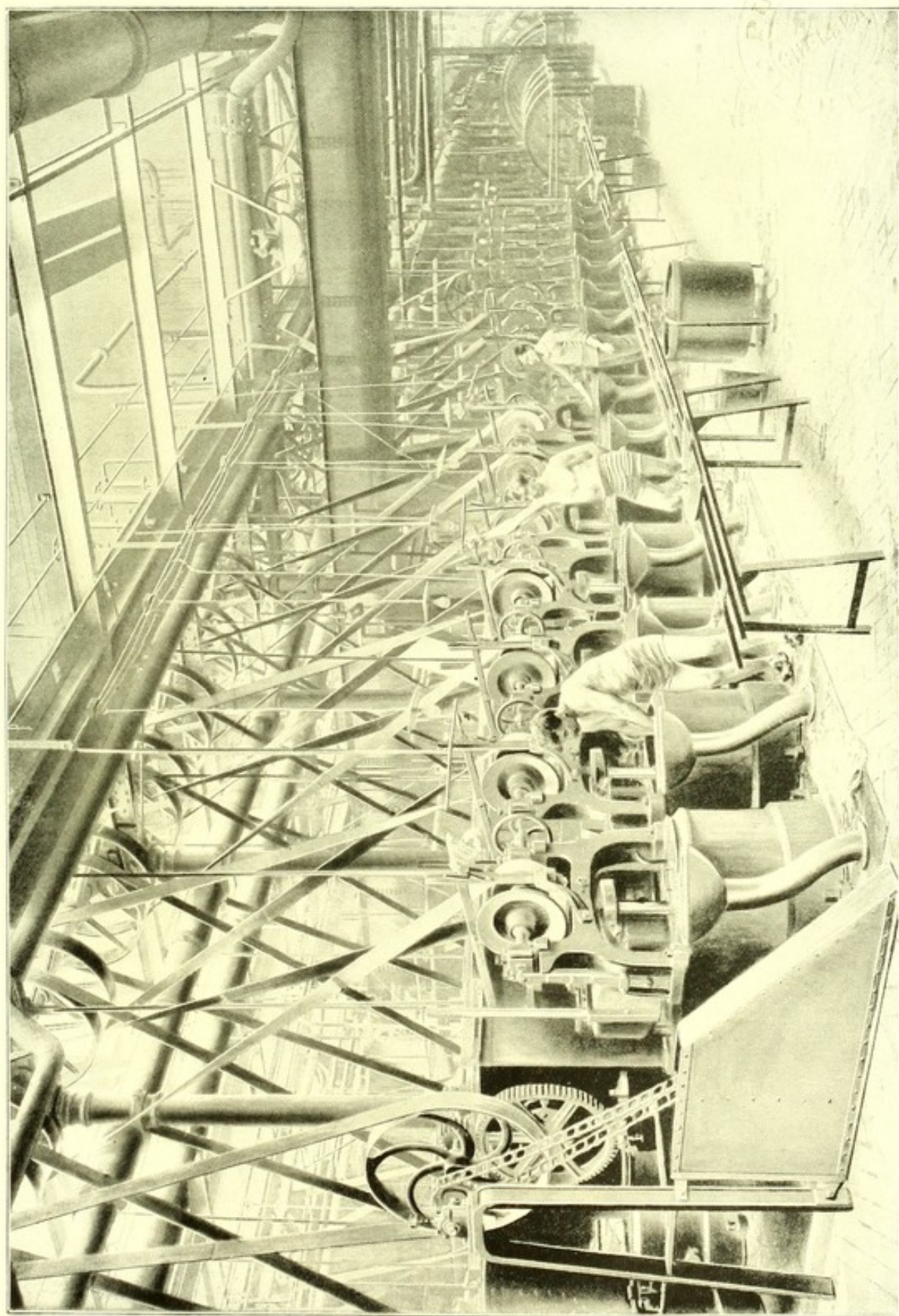
dyed with an aniline dye to match the colour of Demerara, the method adopted by analysts is as follows:—A small quantity of the suspected sugar ("yellow crystals") is stirred up with alcohol. The latter dissolves the yellow dye from the crystals; it is decanted off into a small porcelain basin and the alcohol is evaporated away. The residual colouring-matter is dissolved in a little distilled water with a drop or two of hydrochloric acid, and a few inches of Berlin wool immersed in the solution for an hour or so. The wool is then removed, well rinsed in pure water, and dried. If the wool becomes dyed yellow it is due to the presence of coal-tar dye, and not to natural colouring-matter.

A practical test is to place two samples side by side under the same conditions. In course of time beet loses its colour and its crystals cease to sparkle, while cane retains its appearance.

There are also differences of odour and flavour in some cases which enable one to distinguish beet sugar from cane. But for the most part this applies only to the raw sugars, or to those which have not been well refined. The best method of detecting the odour is to rub up some of the sugar between the palms of the hands before smelling it. Sometimes one sees statements to the effect that cane sugar has a superior sweetness, and a richer flavour than that from beet; but it should be understood that the most highly-refined sugars in the two classes approximate very closely to each other, and the reader should not be disappointed if, in comparing sugars of such character, he finds that his palate is not sensitive enough to detect much difference. One recommendation frequently given for telling whether a sugar is beet or cane, is to put the sugar into a cup of tea without milk;

A BEET-SUGAR FACTORY—SEPARATING THE MOLASSES

Attempts to manufacture beet sugar in England and Ireland have not hitherto proved very successful. A strong effort was made to establish a beet-sugar factory at Lavenham, in Suffolk, in 1868, but it was closed in 1876. On the Continent, however, the manufacture of beet sugar has become an enormous industry; the latest statistics showing the world's production of beet sugar as roughly speaking nearly six-and-a-half million tons, whilst that of cane sugar is under three-and-a-half million tons. Such a development of itself suggests that great capital is now employed in modern sugar factories, and also that inventive skill has been largely applied to their machinery. When the syrupy liquor out of which the sugar crystallizes has reached the granulating stage, it contains a quantity of uncrystallizable matter, the molasses or treacle. (In the cane-sugar industry "molasses" is the technical name for the runnings from raw sugar while waiting for shipment; and "green treacle" is the residue left from raw sugar in the process of refining.) The old-fashioned way of getting rid of this uncrystallizable stuff was by using clay; and a second way was to insert the leaf-stalks of the plaintain in the sugar-casks, when the molasses trickled down the stalks and escaped through holes. The modern method, in the manufacture of both cane and beet sugar, is to use the centrifugal principle. The sugar-liquor after boiling in vacuum pans is introduced into cylinders, which by steam or other machinery are made to rotate rapidly, with the effect of throwing off the liquid molasses. The brown sugar crystals are left, to be subsequently refined.



From a photograph

A BEET-SUGAR FACTORY
Separation of the Crystals from the Molasses



beet sugar, it is said, will turn the tea dark, cane sugar will not. This is due to the presence of a little iron, which is sometimes found as an impurity in low-class beet sugars. The iron combines with the tannin of the tea to form a kind of ink. But that such a general test is misleading in the case of purer sugars, may easily be seen by trying the experiment with, say, some Paris cubes and some English-refined cane-sugar cubes, side by side. Even a trained eye will be unable to distinguish between the results shown by the two. Hence it should be borne in mind that the differences of flavour, &c., are most noticeable in the raw and less highly-refined sugars, and to one who is not an expert they are of little use for the purer kinds. Such statements as that "beet sugar contains very little real saccharine matter" can only be characterized as absurd. Whatever political, patriotic, or business reasons may exist for wishing success to the cane-sugar industry, there is nothing to be gained by such gross exaggerations as the above; and it is better to recognize the beet as what it really is—a dangerous but a worthy rival to the cane.

Analyses made by Dr. James Bell and Messrs. Wigner and Harland show the following percentages of sucrose:—Jamaica, raw cane, 90.40; raw beet, 93.64; Tate's crystals, 99.90; beet crystals, 99.90; beet sugar-loaf, 99.10. Thus the two samples of crystals are each almost absolutely pure sugar.

Dyed Sugar.—The dyeing of sugar is not confined to the beet product. In a case heard at Birmingham a few years ago (in 1900), and in another case at Sudbury, evidence was given to show that some West Indian sugars are dyed with aniline dyes; and as a consequence of this it appears to have been thought that, provided a sugar was a cane sugar, it would be sold as "Demerara" whether dyed or not. In fact, a purchaser usually asks for "Demerara" only in order to get cane sugar instead of beet. As a defendant grocer put the matter in a subsequent prosecution: "In my experience as a grocer, raw sugars—West India cane sugars—come under the designation of Demerara. Customers never ask for raw sugar or West India sugar." But in this latter adjudication (Tredegar, Jan., 1901) it was proved by weighty testimony, viz. that of the government chemist for British Guiana, (1) that the Demerara process of manufacture retains on the crystals the

How Dyed
Sugar is
Detected.

peculiar colouring-matter which is got from the sugar-cane, and also the flavour and aroma characteristic of cane juice; (2) that the Demerara process has been adopted in Trinidad, Barbados, and to some extent in Antigua and St. Kitts; and (3) that Demerara sugar is never dyed or artificially coloured. This case resulted in a conviction, and a heavy penalty was imposed.

A very simple method of detecting most of the aniline dyes that are used for sugar-colouring, without going to the trouble of dyeing wool as above described, is as follows:—Put about a tea-spoonful of the sugar in a small white basin or tea-cup, and pour on it enough pure, colourless, dilute hydrochloric acid to cover it. Mix the substances by gentle shaking. If the sugar is dyed with any of the ordinary dyes the acid will become tinged with pink, red, yellow, or even blue, according to the kind of dye which has been used. With undyed sugar the acid remains practically colourless. Another test is by using a little tannic acid. Dissolve the sugars separately in a tannic-acid solution, when the liquor of the Demerara sugar will remain bright, whilst that of "yellow crystals" will become cloudy. Or again, heat a strong solution of the sugar to be tested with a few drops of sulph-indigotate of potash (indigo carmine); if no change of colour takes place cane sugar is indicated, a change shows beet.

By the Excise the term "raw sugar" is applied to both cane sugar and unrefined beet sugar; and crystallized as well as soft descriptions are included. The term "refined sugar" means all sugars made in, and that have passed through, refineries.

Sugar-Mites.—Raw sugar sometimes contains colonies of the sugar-mite, *Acarus sacchari*. It is not found in refined sugar, being eliminated during the process of purification. The mite is a small animal closely resembling the itch-insect, and capable of burrowing under the skin, with the effect of producing an irritating pustular disease called "grocer's itch".¹ Sometimes it is present in great numbers; Sir Charles Cameron once estimated

¹ As a remedy for *grocer's itch* the following was recommended in *The Grocer* some years ago:—In the first stage, where there are heat and swelling, cold-water dressing will greatly relieve. When the eruption has appeared it should be dusted with finely-powdered starch, white oxide of zinc powder, or chalk. If there be scabs they can be easily removed by softening with oil or bread-and-water, or poultices of mashed turnips; after which use a simple ointment, such as vaseline, or an ointment made of yellow oxide of mercury one drachm, oil of sweet almonds one drachm, and lard six drachms. It is best to take the advice of a surgeon, as tonics are necessary in some cases, and, if possible, change of air.

that there were as many as 100,000 acari present in each pound of the sugar supplied to one of the Dublin workhouses.

The best way of detecting the sugar-acarus is by dissolving the sample of sugar in warm water, when the insect will be found adhering to the sides of the glass, or at the surface or bottom of the liquid. Any suspected particles are drawn out with a glass tube and examined under a low-power microscope; the sugar-mite may be easily identified.

THE GLUCOSES.—The second group of sugars mentioned at the beginning of this article contains some eight or nine different substances, of which, however, only two are of special interest to the grocer. These are (1) *glucose*, which is also called “dextrose”, “grape sugar”, and “starch sugar”; and (2) *invert sugar* (the sugar of honey and treacle), which is a mixture of dextrose and a similar sugar called “levulose”.

The manufacture of glucose from grain or potato-starch is an extensive industry in this country, and in America immense quantities are made, chiefly from yellow maize. “Corn sugar”, in fact, is the American name for the product.

As carried out in England, one process for the conversion is as follows:—The ground and husked grain is mixed in a vat with about four times its weight of water, and two to four per cent of sulphuric acid.¹ It is then boiled for twenty or thirty minutes in a “converter”, under a pressure of about 70 lbs. of steam. The acid converts the starch into the sugar known as “dextrose” or glucose; but the conversion is not complete under ordinary manufacturing conditions, and a quantity of dextrine (gum), and a sugar called maltose, are also formed at the same time: these products remain with the glucose, and the three together substantially make up the commercial article. After the boiling, chalk is added to neutralize the sulphuric acid, the liquid is filtered, partially evaporated in a vacuum-pan, and passed through charcoal to decolorize it. The evaporation in the vacuum-pan is then completed, the syrup being run into moulds and allowed to set if solid glucose is required; if the ordinary liquid form is wanted, the evaporation is not carried so far.

The
Manufacture of
Glucose.

¹ It was with the sulphuric acid at this stage that arsenic was introduced into glucose, and thus eventually into beer, causing the Manchester poisoning epidemic some years ago.

In this country both the solid and the liquid forms are called "glucose"; but in America, whence we import a considerable quantity, only the liquid is termed glucose, the solid varieties being sold as "grape sugar". Glucose is not so sweet as either cane or beet sugar. If the sweetening power of cane sugar be taken as a hundred, that of glucose is only about thirty or forty. Large quantities, chiefly of the solid form, are used by brewers; and the liquid is much employed for jams, marmalades, jellies, syrups, and sweetmeats. It is a frequent adulterant of honey, golden syrup, and treacle. Tanners use glucose for "weighting" leather, and vinegar-makers for the production of vinegar. A small quantity of cane sugar is sometimes mixed with glucose syrup to improve its flavour. Glucose sugar is present in ripe grapes and many other fruits; hence its names "grape sugar" and "fruit sugar". Both the liquid and the solid forms of glucose are subject to a duty of 2s. per cwt. Liquid glucose is imported in casks, those from America averaging 6 cwts., and others from Germany weigh about 8 cwts. each. Glucose, solid or in blocks, arrives in 1-cwt. bags.

Invert Sugar is an uncrystallizable syrup having a sweeter taste than cane sugar. It is now made largely for the use of brewers, being sold as "saccharum", "invert", &c.; and it is found widely existing in honey, molasses, and many fruits. On the manufacturing scale it is produced by heating cane or beet sugar with acids, much in the same way as glucose is made from starch. It is, in fact, a mixture in equal proportions of glucose and a very similar sugar called levulose. The name "invert sugar" is derived from the fact that whereas the cane sugar from which it is made shows a "right-handed" rotation of polarized light when examined in the saccharimeter, the invert sugar itself shows a "left-handed" or inverted rotation. The chief interest of invert sugar for the grocer lies in the fact that it is the principal constituent of honey and occurs largely in treacle.

Saccharine.—This substance is conveniently referred to here, although it is not a sugar, and has, in fact, nothing in common with sugars except its sweetness. It is prepared from toluene, a liquid obtained from coal-tar and closely resembling benzene (benzol). The process is too

Other
Sweetening
Substances.

complicated for description here, but it may be summarized by saying that it consists in treating the toluene (1) with sulphuric acid; (2) with phosphorous chloride; (3) with ammonia; (4) with potassium permanganate; and (5) with dilute acid; the final result being that the original toluene, looking like water and tasting like tar, is transformed into solid crystals about three hundred times as sweet as sugar. Saccharine was discovered in 1879 by a scientific chemist named Fahlberg, working under Professor Remsen of Baltimore.

Large quantities of saccharine are now imported into this country for sweetening purposes. It is used instead of sugar by diabetic patients, and in other medical cases where sugar is objectionable. It is also extensively employed for sweetening aerated beverages, one reason for its use being, no doubt, that it does not ferment and form alcohol, like sugar does. On account of the small quantity needed, it also serves well as the sweetening ingredient of tablets and other medical preparations where smallness of bulk is a consideration.

An import duty of a sovereign per lb. is at present levied upon saccharine, which therefore offers considerable attractions to the smuggler.

"**Sucramine**" is the ammonia compound of saccharine, prepared so as to dissolve easily in cold water, in which the latter is only slightly soluble. It is said to be even sweeter than saccharine (about five hundred times as sweet as cane sugar).

12. HONEY AND SYRUPS

Ordinary honey is a saccharine substance collected by a particular species of bee (*Apis mellifica*) and stored in combs for winter use. It consists essentially of a strong aqueous solution of invert sugar, mixed with 5 to 10 per cent of other sugars and small proportions of gum, wax, pollen, and other vegetable matters. The brands of honey mostly met with are English ordinary, English (or Scotch) Heather, West Indian, Transylvanian, Narbonne, and Californian. Of these the Heather honey, the Narbonne, and the Transylvanian are favourite products. The quality,

and more especially the flavour, of honey varies according to the plants which produce it. From some localities it is mild and bland, from others it is much more aromatic and stimulating to the taste. An ordinary cottager's hive will produce each year from twenty to forty pounds of honey if properly looked after. The substance is usually deposited by the bees in old cells which have become too small to hold the larvæ, or in the ordinary cells after the breeding season is over. After they have been filled with honey the cells are closed with wax until the honey is required for use.

"*Virgin honey*" is the produce of the activity of the younger bees before they have swarmed, and is notoriously of a better flavour and quality than that produced by old bees. But, according to some writers, what is usually called "virgin" honey is simply the portion which first runs from the comb, either with or without the aid of gentle heat; whilst both pressure and heat are used in the extraction of that which follows. The former is the purer and sweeter kind; the latter is more deeply coloured, has a stronger flavour, and contains more impurity. All except the virgin honey is clarified by being gently warmed: the impurities then rise to the surface and are skimmed off. By the use of the microscope it is sometimes possible to discover in what country or region the honey has been produced. What may be seen when
Honey under
the Microscope. thus examined are sugar crystals, scales from butterflies' wings, spores of fungi, and various kinds of pollen-grains. The pollen can often be identified as belonging to particular flowers, and these flowers may be known to grow only or largely in certain districts; hence the source of the honey may in these cases be inferred with some confidence. Besides the substances already mentioned, honey usually contains small quantities of mannite (a kind of sugar produced from manna) and formic acid.

Factitious honey is sometimes manufactured. Its ingredients are glucose syrup, flavouring materials to imitate the genuine honey-flavour, and a minute quantity of formic acid. Even factitious combs, the cells of which are made of paraffin wax, are said to be fabricated in America. Liquid glucose is also frequently used as an adulterant of natural honey. The sophistication, if judiciously done, is not very easy to detect; and added invert sugar is even more difficult of identification. One point, however,

may be noted about these substances: the invert sugar is uncrystallizable, and the glucose syrup may contain much dextrine, which tends to prevent crystallization. Now experienced beekeepers hold that all genuine honey will sooner or later crystallize, and hence that honey warranted to remain syrupy probably contains invert sugar, glucose syrup, or some similar adulterant.

A fair idea of the general composition of commercial honey may be gathered from the following analyses:—

	English honey taken from comb.			Narbonne honey.		
Moisture	17.4 per cent.	.....	17.1 per cent.	
Invert sugar	71.7 "	.....	74.0 "	
Other sugars	10.1 "	.....	7.1 "	
Gum, wax, pollen, &c.	0.7 "	.....	1.5 "	
Mineral matter	0.1 "	.....	0.3 "	
			100.0		100.0	

The Narbonne honey is a light-coloured kind, very granular, and highly aromatic. West Indian honey produced in Martinique is a thick and syrupy article with a peculiar scent, and is much esteemed locally.

Honey is mildly laxative in its properties. Some few kinds are more or less poisonous; as, for example, a reddish variety found in Brazil. It may be remarked that bees are not the only insects which produce honey: the Mexican honey-ant collects and stores quite a notable amount.

German Honey-Tea, a wholesome drink, is made by pouring a tea-cupful of hot water on one to two tea-spoonfuls of honey.

SUGAR SYRUPS.—Molasses, treacle, and golden syrup are the uncrystallizable juice of the sugar-cane, or other source of sugar, left after the crystallized sugar has been separated. As explained under "Cane Sugar" the long-continued heating of the juice results in the conversion of a part of the cane sugar into invert sugar, which not only is uncrystallizable itself, but also prevents a portion of the cane sugar crystallizing. The liquid thus drained or left is the molasses.

Molasses.—The term is sometimes used in a general sense to include treacle and syrup. But molasses is usually distinguished as the liquid which is obtained in the preparation of raw sugar from the cane juice, whereas treacle and the syrups are produced

in the process of refining raw sugar. In other words, molasses is drained from unrefined sugar, and treacle from refined sugar.

Average molasses contains about 35 per cent of sucrose or cane sugar, 20 each of invert sugar, organic impurities, and water, and 5 of ash. It is generally darker in colour than treacle, and contains more impurities.

Treacle.—After the refined sugar has been separated as far as is profitable, the residual syrup is either manufactured into treacle or into invert sugar ("saccharum"), the finer qualities of the treacle being further distinguished as golden syrup.

When the drained-off syrup has been obtained from cane sugar it is generally only necessary to dilute it with water, heat it to 160° F., pass it through animal charcoal to filter it, and then boil it down to the required density.

When, however, the syrup is from beet sugar, or from a mixture of beet and cane, it contains so little invert sugar that it is liable to crystallize gradually and become unsaleable on keeping. To prevent this, the syrup before filtering is boiled with a little acid to partially "invert" it—*i.e.* to convert some of the cane sugar into invert sugar—which prevents the crystallization. The acid is then removed with chalk, and the syrup is filtered and boiled down as above.

The average composition of common dark treacle may be taken as—

¹ Sucrose or cane sugar	...	...	33 per cent.
Invert sugar	...	...	37 "
Water	...	...	23 "
Ash	...	...	3 "
Organic matter other than sugar			4 "
			100

Treacle is somewhat more laxative than sugar, and is not so pure, since it contains about 4 per cent of other organic matter and more or less free acid. It has, however, good sweetening properties, and for some purposes is as useful as sugar, except that it contains upwards of 20 per cent more water. A good treacle ought not to have any marked empyreumatic flavour.

Golden syrup is the name applied to the finer kinds of treacle or syrup which are produced as above described during the refining of

¹ Sucrose or Cane Sugar: the sugar is not necessarily derived from the cane.

raw cane sugar. It is lighter in colour than treacle, and generally contains more cane sugar and less invert sugar. One analysis is as follows:—

Cane sugar	...	...	...	39.0 per cent.
Invert sugar	...	...	...	33.0 „
Water	...	...	...	22.7 „
Ash	...	...	...	2.5 „
Organic matter not sugar	...	...	...	2.8 „
				<hr/>
				100.0

But there are, of course, various qualities—common, good, and fine; the grades depending more upon the colour and flavour than on the amount of sugar. It commands a higher price than treacle, and is somewhat purer, though not necessarily of greater sweetening power.

Green Syrup is that which drains from the moulds during the making of loaf sugar. It is therefore the purest kind of syrup, and contains more cane sugar (sucrose) and less invert sugar or glucose than either treacle or golden syrup. One analysis is as follows:—

Sucrose or cane sugar	...	...	...	62.7 per cent.
Glucoses or invert sugar	...	...	...	8.0 „
Water	...	...	...	27.7 „
Ash	...	...	...	1.0 „
Organic matter other than sugar	...	...	...	0.6 „
				<hr/>
				100.0

Although green syrup is purer than the other syrups it is rather less sweet than many. This is because it contains a larger proportion of water and a smaller quantity of invert sugar. On account of this last deficiency, the green syrup represented by the above analysis would be very liable to crystallize if it were kept long, unless precautions were taken to prevent loss of water by evaporation. In storing syrups it is always a good plan to keep them well covered up.

Imitation syrups are sometimes made up by mixing liquid glucose with a proportion of refuse molasses. The latter ingredient supplies the treacle flavour and colour.

“**German Treacle**” is a substance said to be made from an extract of juniper berries. It is quite a different article from ordinary treacle.

Of treacle and syrup as imported the average weights are:—

Puncheons, about 12 cwts.; casks, from 6 to 8 cwts.; and barrels, about 3 cwts.

FRUIT SYRUPS.—These are essentially strong solutions of sugar, containing about 14 lbs. of sugar in the gallon of syrup, and either flavoured with the concentrated essence of the fruit or else made up with the juice expressed directly from the fruit itself. A little acetic, tartaric, or citric acid is generally added to prevent the crystallizing of the sugar and to impart a pleasant acidity; and sometimes a small quantity of salicylic acid or bisulphite of lime is used to prevent fermentation. The syrups are coloured as desired with such substances as aniline red, liquid carmine, or cochineal. Some of the varieties most in favour are Lemon, Raspberry, Strawberry, Pine Apple, Currant, and Cherry.

Below are a few typical recipes for the manufacture of simple and fruit syrups. With a little trouble the grocer can make many of these articles for himself. The recipes are taken from a large number given by Mr. E. Skuse in *The Confectioner's Handbook*.

Simple Syrup.—Dissolve 15 lbs. of white sugar in a gallon of water, with gentle warming, and pass it through a strainer. When cold, beat up a little of the syrup with the white of two eggs, and then well mix this with the main quantity. The syrup is best kept in stoneware jars.

Capillaire.—Boil 9 lbs. of loaf sugar with 5 lbs. of orange-flower water until the sugar has all dissolved and the liquid is clear. Whilst still hot, strain the syrup through a flannel bag. Then dissolve 2 drachms of tartaric acid in 8 ounces of the strongest orange-flower water, and add this to the cooled syrup. Finally, to this mixture add 4 ounces of best Rhenish wine.

As already stated, the fruit syrups are prepared either from the fresh fruit itself, or, much more easily, from the simple syrup above-mentioned, by the use of fruit essences, which can be purchased ready prepared. In the first case, a quantity of good fresh fruit, free from leaves and stalks, is mashed up with a clean wooden pestle in a clean tub or other suitable vessel, and is then allowed to ferment for four days after the addition of about 2 per cent of its weight of powdered loaf sugar. The temperature should be kept fairly regular at about 68° F. At the end of that time the juice is

Various Fruit
Syrups.

How Fruit
Syrups are
Made.

pressed out from the fruit and allowed to settle for a couple of days in a cool cellar. After being poured off through a strainer the clear juice is gently simmered with loaf sugar, using 18 lbs. of the latter to every gallon of juice. Whilst still warm the juice is strained through flannel; and after cooling, the colour can, if desired, be improved with a little aniline colouring. The latter should be used carefully, as a very little is sufficient to colour a large quantity of liquid. The syrup is ready for bottling as soon as it is cold. If intended for exportation to hot countries it is advisable to add spirits of wine, in the proportion of 1 lb. of spirits of wine to each 100 lbs. of syrup.

Without making it directly into syrup, fruit can be kept for future use, unboiled, in the following way:—Make a preservative solution by dissolving salicylic acid and sugar in water, using for every gallon of water $13\frac{1}{2}$ grains of the acid and 23 grains of sugar. Place the fruit in this solution, and cover the jars or bottles with bladder. Such fruits as cherries, currants, raspberries, pears, and grapes can be kept in this way for a twelvemonth. The expressed fruit-juice can be kept by means of the same preservative.

Lemon Syrup from the Fruit.—Grate off the rind from a number of lemons, and beat it up with some granulated sugar. Express the lemon-juice from the fruit, and to each pint of juice add 1 pint of water and $3\frac{1}{2}$ lbs. of granulated sugar, including in this weight the sugar which has been rubbed up with the rind. Warm the whole until the sugar is dissolved, then strain the syrup and bottle it.

Lemon Syrup from the Essence.—Take 6 pints of simple syrup, 2 pints of distilled water, and 2 ozs. of soluble essence of lemon dissolved in a little boiling water. Mix; and, if required, colour with a little saffron.

Strawberry and Raspberry Syrups from the Fruit.—Wash the fresh fruit, express the juice, and to each quart add $3\frac{1}{2}$ to 4 lbs. of granulated sugar. The juice, heated to 180° F. and strained or filtered before dissolving the sugar in it, will keep for an indefinite time.—Or proceed as described above for fruit generally.

Strawberry and Raspberry Syrups from the Essences.—Take 6 pints of simple syrup, 2 pints of distilled water, 2 ozs. of tartaric acid, and 2 ozs. of the concentrated strawberry or raspberry fruit essence. Mix the whole, and colour as desired.

13. SPICES

It is by no means an easy matter to become a really good judge of the many spices and condiments which the grocer may be called upon to supply. One requires a sharp eye, a keen sense of smell, a discriminating palate; and to these qualifications must be added, as a *sine qua non*, long practice in handling and appraising the various goods. As a primary requisite, however—and this even if one does not wish to become much of an expert in the matter,—it is desirable to have some knowledge of the origin, history, and chief characters of the various substances met with: of the gingers and the peppers, the nutmegs and the cloves, the mustards and the sauces. In a broad, general sense the term “condiments” covers not only all the preparations here dealt with, including the spices and sauces, but other appetizers Uses of Con-
diments, &c. such as vinegar and pickles—anything, in fact, that is used as a seasoning for food. But it is convenient to subdivide these articles into smaller classes, and to use here the word “condiments” more especially in a restricted sense as denoting the simpler seasonings like salt, pepper, and mustard. These three are the most elementary appetizers, and in fact are the only ones available for some millions of human beings, who have as their only condiment with their diet of rice a pinch of pepper or a sprinkling of salt.

“Spices” may be held to include pepper, but for present purposes the more aromatic products only are conveniently grouped under this head. This accords, too, with the general idea of what is meant by a spice. All these various seasonings or condiments are of utility in gratifying the palate, and in addition they probably stimulate the secretory digestive juices. Some of them certainly increase the flow of saliva, although, on the other hand, the tendency of those which contain much acid (*e.g.* vinegar) is rather to prevent the perfect action of the salivary ferment upon the food during digestion. Solid varieties of food are not infrequently dry in substance, unattractive in taste, or insufficiently flavoured. Sauces make such dry food moister; they lubricate it, and increase its palatability by contributing different or stronger flavours. When sauce is missing, salt, or

salt and pepper, must supply its place as a corrective of taste and stimulant of secretion.

Allspice. — Allspice, or, as it is now more usually termed, **Pimento**, is the dried berry of a West Indian species of myrtle, known botanically as *Myrtus Pimenta*, and popularly as the pimento-tree. At the present time the pimento is chiefly cultivated in Jamaica, whence the spice derives its third name of "Jamaica Pepper". It is, however, not a pepper at all. The tree itself is an evergreen with white, fragrant, aromatic flowers, and leaves of a deep shining green. The berries, which are of small size, grow in little racemes or branching clusters, and are picked before getting quite ripe, since much of the characteristic flavour is lost if the berries are allowed to reach maturity. After being gathered, the racemes are dried either by exposure to the sun or in kilns; and the berries, which have by this time changed in colour from green to brown, are stripped from their stalks and are now ready for packing.

The flavour of pimento is thought to resemble that of a mixture of cinnamon, nutmegs, and cloves, whence the product has obtained the popular name of "allspice". This special flavour and aroma are due to small quantities of an essential oil, which is chiefly contained in the ligneous pericarp or "shell" of the berry, and which is most abundant when the fruit is still in the unripe condition. As a consequence, the smaller berries are often more fragrant than the larger, more nearly ripe ones, and these smaller and more fragrant berries are hence more esteemed.

Allspice is employed not only in cookery, but also in medicine as an agreeable aromatic, and it forms the basis of a cordial and a water. Certain substitutes for the genuine allspice are occasionally mixed with the berries, the principal being the fruits of the bayberry tree (*Pimento acris*) and "Mexican spice" (the fruits of the *Pimienta di Tabasco*). Both these substitutes are berries of rather larger size than those of the true pimento, and they differ from the latter in general appearance also.

Cassia Ligneæ, or cassia wood, is the bark of *Cinnamomum cassia* and other varieties of the cassia-tree, which flourish in China and the East Indies. The cassia is a large tree of the laurel order; it sometimes attains a height of 60 feet or more, and throws out long spreading branches at right angles

to the stem. Although the cassia bark is very similar to cinnamon, it is generally thicker, and can also be distinguished by its different fragrance and aroma. The thinner kinds of cassia bark approach more nearly to cinnamon in taste than the thicker varieties do, and are consequently more valued than the latter. India, China, Singapore, Batavia, and Mauritius are the chief exporters of cassia to this country.

Cassia Buds are the dried fruit of the cassia-tree. The best kinds have a rich flavour of cinnamon, and are free from stalk and dirt.

Cinnamon.—This favourite spice is the inner bark of shoots from the cinnamon-tree, an aromatic plant allied to the laurels, and growing more especially in Ceylon, but also found native or cultivated in a number of other places, including Borneo, Sumatra, Java, Mauritius, Jamaica, and Brazil. The tree, the Ceylon variety of which is known to botanists as *Cinnamomum zeylanicum* (or *Persea cinnamomum*), grows to a height of some 25 to 30 feet, and yields cinnamon from the fourth year onwards. It may still be productive when as much as 200 years old; the best bark, however, is obtained from branches which are about in their fourth year of growth. The bark is stripped off twice a year at the time of the monsoons, the first crop, which is also the best, being obtained in June and July, and the second and smaller harvest in November and December. To prepare it for the market the bark is scraped until the outer epidermis is removed, and the inner layer is then cut up into slices and dried—at first in the shade, gently, and afterwards in the sun. During the drying process the slices curl up into rolls or “quills”, the form in which it appears in trade before being ground.

The finest kinds of cinnamon are obtained from Ceylon, but there are several varieties and more qualities. That which is best esteemed is of a light-yellow colour, with a peculiar sweetish aromatic taste, not thicker than good drawing-paper, smooth, and of pliable texture, eventually breaking with a splintery fracture when bent outwards. When chewed it easily disintegrates and becomes soft; its flavour is mildly pungent, not “biting” or hot, and it leaves no after-taste. Owing to the high price of cinnamon it has become a common practice

to substitute for it, or mix with it, the bark of cassia, which so closely resembles it in flavour as to readily deceive the uninitiated. Cassia bark, however, is thicker and coarser than cinnamon; it is less "quilled"; its fracture is short and resinous, its flavour is more hot and "biting"; and it lacks the mild, sweetish taste of good cinnamon. Genuine but inferior qualities of cinnamon are darker and thicker than the best, whilst their flavour is bitter and acrid, and they do not become soft when chewed. Clove stems, guava bark, and, in the ground state, powdered walnut shells are said to have been met with as adulterants of cinnamon.

"Chinese Cinnamon" is wholly prepared from cassia bark.

"Cinnamon Chips" are small pieces and cuttings, good qualities fetching about one-third to one-half the price of ordinary best cinnamon. "Strips" and "Bark" are inferior fragments of still lower value.

"White Cinnamon" is the dried bark of the tree *Canilla alba*, which flourishes in the West Indies, Florida, and the Bahamas. It is called "white" from the silvery outer skin or cortex, which is often not removed completely from the inner aromatic bark, and consequently gives it a light-coloured appearance. The spice is not now very frequently met with. It is "quilled" like true cinnamon, but the rolls are not so well formed. On the inner surface the colour resembles that of ordinary cinnamon, and the odour is also similar in the two cases, whilst the flavour is aromatic but more pungent and bitter than that of the true cinnamon.

Essential Oil of Cinnamon is obtained by distilling with water waste pieces of cinnamon bark, leaves, flowers, and roots, which have been previously ground up and macerated with brine for some days. It is a volatile and pungent oil with a fine aroma of cinnamon, and of yellowish-red colour. Its chief constituent is an interesting chemical substance called "cinnamic aldehyde", which can also be manufactured from coal-tar. Chinese oil of cinnamon is reputed to be the best.

Cardamoms.—The cardamoms officially recognized by the Pharmacopœia are the seeds or fruits of a tall sedge-like plant known to botanists as *Elettaria cardamomum*, and growing in the East Indies. But there are several varieties of cardamoms

used as spices and produced by plants of another genus, *Amomum*, of the same order as the ginger plants. India, Ceylon, and Java are the chief countries whence cardamoms are obtained. Cardamoms are small dark-brown seeds of aromatic odour and warm, rather pungent, taste. In trade they are usually classed as greater and lesser cardamoms, several varieties being mixed together in each class. They have somewhat considerable use in pharmacy on account of their carminative and stomachic properties, and are also employed in veterinary medicine. For culinary purposes they are well-known admixtures in the spicing of cakes, cordials, sauces, and curries.

Cubebs are allied to the peppers, being produced by climbing shrubs of the genus *Cubeba*, belonging to the natural order of plants *Piperaceæ*. Commercial cubebs consist of the dried berries, generally with the stalks attached; they are small globular fruits somewhat less in size than white peppercorns. The outer covering is wrinkled, and of a brownish or blackish colour; the seed, when present, is hard and white. The variety of cubebs used in pharmacy is obtained from the species *Cubeba officinalis*, which is found in Java, Sumatra, and Borneo. Cubebs have a pleasant aromatic odour, and a pungent, somewhat bitter taste. In the East they are in general use as a condiment, but here they are mainly employed as a drug. Their medicinal properties are those of a gentle stimulant and stomachic.

African Cubebs, also known as *West African Black Pepper*, is a variety of which the berry is smoother than that of common cubebs, and which has usually a curved stalk. It is produced by the plant known as *Cubeba Clusii*.

Capers are the flower-buds, pickled in vinegar, of the caper-bush (*Capparis spinosa*), a shrub common in Southern France, Spain, and Italy. The buds are picked daily as they develop during the summer and autumn months, and placed in strong white vinegar. Later on they are passed through sieves to sort them out according to their different sizes. Several grades are recognized: the smallest, being also the youngest, are deemed the best; these in France are classed as "superfines" and "non-pareils", whilst the largest or *Communes* are the cheapest, selling at about one-fourth the price of the superfines. Intermediate grades having values between these are known as fine or medium fine.

Capotes and *Capuchines*. The French capers are held in the highest repute as regards flavour and keeping qualities, especially those grown in the Provençal district, for which Marseilles is the chief emporium. Considerable quantities of capers are also exported from Spain and Italy. Of these some come to England *via* France, and are said to masquerade as French capers after the journey. Africa and Majorca also send us some cheaper qualities of the spice. Capers are said to probably owe their characteristic flavour to the presence in them of *capric acid*, a white crystalline solid which is also found in fusel-oil and in cocoa-nut oil. Copper is sometimes found in the liquor of capers. It is in most cases probably derived by the action of the vinegar upon the copper wire of the sieves used for sorting; but it is also alleged to be sometimes purposely used for improving the colour of the capers. To test for the presence of copper, immerse one end of a bright knitting-needle in the liquor for a night, and examine it the next day to see if there is a red film of deposited copper on the submerged part.

Cloves are the dried unopened flower-buds of the clove-tree, *Eugenia caryophyllata* (or *Caryophyllus aromaticus*), a kind of myrtle originally brought from the Moluccas, but now cultivated, for the sake of the spice, in Zanzibar, the West Indies, Guiana, Brazil, Amboyna, and other tropical districts. By far the largest quantity of cloves is produced in the East Africa region, Zanzibar being the principal centre of the trade, and Pemba largely devoted to it.

The clove-tree is a tall, slender tree, which may be as much as 35 to 40 feet high, but is usually a great deal less. Its flower-buds, which grow in clusters somewhat after the manner of the honeysuckle, are nearly white when young, but later become green, and then bright red, at which stage they are gathered. If left too long, the buds unfold into flower, and the resulting cloves are of inferior quality. The crop is harvested mostly by hand-picking, but in the Moluccas the branches of the trees are sometimes beaten with long bamboos, the buds being collected on cloths placed beneath the trees to receive them. Since the buds are liable to lose some of their aroma during drying, the process is carried out as rapidly as possible—generally in the shade, but sometimes in the sun, or with wood fires. When

dried, the clove is of a dark-brown or reddish colour, and consists of a wrinkled calyx-tube, partially enclosing at one end the folded, knobby bud. Cloves of good quality have a strong aromatic odour, a hot, spice-like taste, and leave traces of oily moisture on the fingers when rubbed in the hand. If squeezed between the fingers the oil comes out where the nail presses; if it is an exhausted clove no oil will appear. Their colour varies somewhat, but should be fairly uniform in each kind. Brown is the general colour, and a reddish or red tint is more esteemed than black; but Amboyna cloves are classed among the best, although blacker than other varieties. A clove should not float horizontally when placed in water; this shows the oil has been distilled out of it. Chemically, cloves contain 18 to 22 per cent of volatile oil, 5 to 7 per cent of resin, and 25 to 30 per cent of gum resin, &c.

Of the many kinds of cloves met with in trade, those from Penang have the best reputation, the Amboyna products, which
 Various Kinds of Cloves. are small as well as black, ranking next, followed by the Zanzibar and Pemba cloves, the two last being often mixed. Cloves which have been well dried in the tropics may absorb moisture from the air and increase in weight when exposed to the damp climate of this country. They are sometimes placed in a moist atmosphere for this purpose. On the other hand, cloves which have been shipped rather damp, as the Pemba cloves are alleged to be, may lose weight instead of gaining it upon keeping.

The chief sophistications of cloves consist in mixing the cloves either with an excessive quantity of the stalks, or with cloves from which a part of the oil has been extracted, and which are therefore deficient in aromatic properties. This last admixture is detected by carefully examining the sample to see if there is any considerable number of cloves present which are notably light-coloured, shrunken, and lacking the head or knob; also by the tests given above. Sometimes artificial cloves, made of paste and coloured, are sent into the market!

"**Mother of Cloves**" is the unripened *fruit* of the clove-tree, which is imported in a preserved condition, and used in pharmacy as an antispasmodic and stomachic. The fruit resembles small olives in shape, and tastes like cloves, but milder.

Oil of Cloves is a volatile oil obtained by distilling the young

flower-buds of the clove-tree with water. It has a faintly-yellow to brownish colour, a characteristic odour of cloves, and a hot taste. The oil is used for flavouring liqueurs, &c., and for scenting soaps, also as a remedy for griping pains and toothache, and for mounting microscopic objects.

Essence of Cloves consists of a solution of oil of cloves in alcohol; the proportions vary, but about 10 per cent of the oil and 90 of the spirit are average quantities. It is used as a flavouring ingredient in cookery.

The **Ginger** plant is not actually known to grow wild, but is generally looked upon as being indigenous to the warmer districts of Asia. From there it has spread over a wide area into the West Indies, South America, western tropical Africa, and Australia. Our principal ginger supplies are known as Jamaica, Cochin, African, Bengal, and Japan ginger, from the respective countries of shipment. Ginger is the rhizome or underground stem of a perennial reed-like plant (*Zingiber officinale*), which grows to a height of some 3 or 4 feet. The flowers are borne on a separate stem from the leaves, forming at the apex of the stem a dense cone-like spike from 2 to 3 inches long. The leaves are large and broad, springing alternately from opposite sides of the leaf-stem. Both the flower-stem and the leaf-stem rise from the creeping underground rhizome which forms the "ginger" of commerce. In Jamaica the time of planting is in March or April, and the flowers appear in September. Towards the end of the following January, by which time the flowers have run to seed, the rhizomes are dug up and cut off for washing. If left too long in the ground they become fibrous; if taken up earlier they are more succulent, and are then suitable for preserving.

Two distinct forms of ginger occur in commerce, and are known respectively as "coated" and "uncoated" ginger. The difference between the two consists in the epidermis of the rhizome being retained in the one case and removed in the other. To obtain the "coated" variety (also called "black" and "unscraped") the pieces of rhizome, which are technically called "hands" or "races", are roughly cleaned, plunged into boiling water to kill the buds, and dried in the sun. *Dark-coloured whole ginger*, which belongs to this coated variety, is often prepared from the older and tougher rhizomes. Coated

Ginger—Coated
and Uncoated.

ginger generally has a brown striated surface, more or less irregularly wrinkled, and when broken it presents a dark brownish fracture which is usually of a hard character, and has sometimes a horny and resinous appearance. African and some kinds of Bengal and Cochin ginger are the chief coated or rough kinds imported.

For *uncoated* or *white* (or "scraped") ginger the rhizomes are prepared by scraping off the buds and outer dark-coloured skin, and are not plunged into water like the coated. They are often subjected to a process of bleaching, either by immersing them for a short time in a solution of bleaching-powder, or by exposing them to the fumes of burning sulphur. An artificial white coating is also sometimes applied by dipping the ginger in a wash of chalk and water, or of calcium sulphate and water. Although this whitewashing may improve the appearance, it may also serve as a disguise for inferior qualities of ginger; and it is well to know that these coverings may be readily detected by the ease with which they can be rubbed off, and by their usually leaving a white powdery deposit in the vessel in which the ginger has been stored. When not thus whitened, uncoated ginger has a pale-buff colour. In texture it is rather fibrous, and breaks with a short mealy fracture showing many short fibres. As met with in trade it varies in size from single joints an inch or so in length to irregular branching "hands" of several joints and 3 or 4 inches long. The uncoated ginger is usually of a superior quality to the coated kinds; but there are, of course, several grades of each country's products, such as "finest", "fine", "good", "medium", "low", and "common". Jamaica and Cochin are the two best-esteemed varieties, the most valuable pieces being the largest and finest, of a pale-buff colour throughout, and cutting softly and evenly.

Preserved Ginger.—This consists of the young, green, and succulent rhizomes, washed and scraped, and preserved in syrup; and also of the stem and leaf preserved in the same way. It is imported both from the West Indies and from China, the Chyloong and the Peiwoong brands of the latter country being two favourite kinds.

Crystallized and Glacé Ginger, Ginger Candy, and Ginger Chips or lozenges are all forms of sweetmeats produced from sugar and ginger. The general methods of crystallizing and candying such articles are explained elsewhere.

Although chiefly employed as a spice or condiment, ginger finds some application in medicine. It is used as an aromatic, stomachic, and gently stimulating medium in some forms of dyspepsia and flatulence, and is also given with purgatives to correct griping. Its principal chemical constituents are *ginger-starch*, volatile or essential *oil of ginger*, and *ginger-resin*. The characteristic odour and flavour of ginger are due to the volatile oil. Whole ginger is only liable to the kind of sophistication which has already been mentioned, viz. the "liming" of inferior qualities to improve their appearance; but **ground ginger** is more or less likely to be mixed with various foreign ingredients.

Ginger tea is an old-fashioned remedy for colds. "Switchel" is a hay-field drink made from ginger and water, with molasses and a little vinegar added.

Mace is a foliaceous investment covering the shell of the nutmeg, and is an example of what is termed by botanists an *aril* or *arillus*. It is itself surrounded, when growing, by an outer fleshy or toughish layer forming the external portion of the nutmeg fruit (see NUTMEG). When the fruits are gathered, this outer part separates, much in the same way as the yellow rind or "shell" of a ripe horse-chestnut opens, and the bright-red arillus or mace is then stripped off the inner seed and pressed flat between blocks of wood, or in presses. The mace is then dried by exposure to the sun, during which time it acquires a yellowish or brownish-yellow colour. It may also be subjected to a process of "curing", which consists in steeping it in brine or sea-water and then drying it. About a pound of mace a year is produced on an average by each nutmeg-tree.

Mace and its
Adulterants.

The mace we import is for the most part East Indian, with a smaller quantity of West Indian, the latter commanding a somewhat lower price than the former. The East Indian mace is usually classed for sale purposes as fine, good, medium, and ordinary; and in the manufacture various kinds are distinguished, such as Finest Pickled Flake, Fine, and Ground Mace. Good mace should have a fresh appearance and bright colour, be rather tough than brittle, and possess the pleasant aromatic odour characteristic of the spice. The flavour is essentially that of the nutmeg, but is considered to be somewhat more delicate. The smaller pieces are looked upon as the better mace.

The sophistications to which mace is liable consist in the addition of inferior kinds of arils, such as those of wild mace and of certain products known as "Malabar" and "Bombay" mace; or else in the admixture with genuine mace of a portion from which the essential oil has been more or less completely removed. Sometimes there may not even be any of the genuine product present, the mace consisting wholly of that from which the oil has been extracted. The inferior kinds are said to be deficient in the true mace-flavour, but it is sometimes by no means easy to detect much difference in this respect between the lower qualities of genuine mace and those alleged to be mixtures. In addition to the inferiority of flavour, there are some other points of difference which help in detecting the admixtures. Thus "Malabar" mace has a resinous taste when chewed; and "Bombay" mace is larger than genuine mace, has a different shape and structure, and shows different microscopical characters.

Mace yields about 2 per cent of ash, and contains about 10-12 per cent of moisture; whilst something like 40-45 per cent of the spice is dissolved when the sample is extracted with alcohol. Such an alcoholic extract, after being filtered clear, constitutes one form of **Essence of Mace**.

The **Nutmeg** is the seed or kernel of the fruit yielded by the nutmeg-tree (*Myristica moschata*, *M. fragrans*, *M. fatua*, &c.), a tropical plant indigenous to the Moluccas, and growing also in Hainan, the Banda Islands, the East Indies, Madagascar, and the West Indies. The trees are of about the size of pear-trees, and resemble them in foliage and general appearance. They bear fruit when about ten years old, each tree yielding something like 10 lbs. of nutmegs every year. The fruit itself is yellow or peach-coloured, and in shape and size resembles more or less the fruit of the walnut-tree. It comprises four distinct and separable parts; in the centre is the nutmeg or *seed* itself, enclosed in a thin, hard, crustaceous "testa" or *shell*; which in its turn is closely enveloped by its *aril* or mace; whilst outside all is a fleshy or rather tough casing or *rind*. Both this rind and the whole fruit itself are preserved and used as sweet-meats, the fruit for this purpose being collected while still unripe, and before the seed has hardened. In preparing the nutmegs for

trade purposes the thick rind and underlying mace are stripped off, and the seeds in their shells are slowly dried for a few weeks, until the kernel has shrunk away from the shell and the latter has become brittle enough to crack easily when struck. During the last stages of this drying process the articles are exposed to the sun for an hour or two each day, the object of the whole operation being to allow of the shell being broken cleanly away without damaging the nutmeg inside. After being thus freed from the shell, the seeds or nutmegs are sorted out according to size, and the largest, averaging, say, 160 to the lb., or fewer, are shipped for the European market. The smaller nutmegs, and those which are defective, are used for grinding and extraction of their oil. The larger and more compact the nutmegs are, the greater is their value. In the English trade those from East India are usually classed into four grades according to sizes and condition; namely, nutmegs of which 60-70 weigh 1 lb., those of which 80-110 go to the lb., and those averaging 120-160 for the same weight:

**Grades of
Nutmegs.**

these form the first three grades in order of decreasing value, and the fourth comprises wormy and shrivelled or otherwise defective nutmegs. These "wormy" nutmegs are such as have been attacked by certain maggots and larvæ of a kind of beetle, to the ravages of which insects nutmegs are specially prone. In order to prevent this the dried kernels are put through a liming process, being dipped several times into a thick cream made of powdered calcined shells and brine. The coating thus given them serves largely to protect the nutmegs from the insects referred to. Round nutmegs are considered the best, a long oval shape being indicative of wild nutmegs, or others of inferior quality. Finest Penang nutmegs are brown and free from lime.

Oil of Nutmegs.—By expression an oil can be obtained from nutmegs, and this when distilled with water yields a highly aromatic volatile essential oil (oil of nutmegs). In addition to this volatile substance it also affords a yellow fixed oil termed *Butter of Mace*, which is employed in India as a liniment. **Essence of Nutmeg** is an alcoholic solution of the volatile oil.

Mixed Spice, or Pudding Spice, is a mixture of several ground spices, usually with either rice-flour or sugar or with both. Cinnamon, cloves, nutmeg, and mace, with caraway and coriander seeds,

are perhaps the most frequently used ingredients, but the constituents and the proportions naturally vary with the price, and the cheaper components preponderate in the lower qualities of mixed spice. Some recipes which have been given are as follows:—

	(1)	(2)	(3)
Rice-flour, ...	30 per cent	51 per cent	28 per cent
Sugar, ...	19 "	15 "	—
Caraway, ...	15 "	3 "	28 "
Cassia, ...	—	14 "	—
Cinnamon, ...	—	6 "	28 "
Cloves, ...	6 "	5 "	—
Coriander, ...	30 "	1 "	—
Ginger, ...	—	1 "	—
Mace, ...	—	4 "	11 "
Nutmeg, ...	—	— "	5 "
	100	100	100

[Though the rice-flour and sugar mentioned in the recipes are frequent ingredients of mixed spice, it would be well to remember that objection might be raised to them on the ground that, strictly speaking, neither substance is a spice. Nevertheless each has its use in modifying the flavour of the mixture.]

The average weights of various spices on the wholesale market are these: Pimento, bags, 1 cwt. 1 qr. Pimentine, bags, 1 cwt. 2 qrs. Cinnamon (Ceylon), bales, 3 qrs. 14 lbs.; (China), boxes, 2 qrs.; (Tellicherry), bales, (each), 3 qrs. 16 lbs., cases (net), 1 qr. 12 lbs.; Chips (Ceylon), bags, 2 qrs. 4 lbs. Cassia Lignea, cases, 2 qrs. 8 lbs.; Vera, bales, 2 qrs.; Buds, cases, 1 cwt. 1 qr. 7 lbs., boxes, 2 qrs. 14 lbs. Cloves (Zanzibar and Amboyna), packages, 1 cwt.; Penang, cases, 2 cwts. Clove Stalks (Zanzibar), bales, 1 cwt. Ginger (East India), cases, 2 cwts., bags, 1 cwt.; (Jamaica), barrels, 1 cwt. 1 qr.; (African), bags, 3 qrs. Mace (East India), cases, from 1 cwt. 2 qrs. to 3 cwts.; (West India), cases, from ½ cwt. to 1 cwt. 2 qrs. Nutmegs (East India), cases, 2 cwts. 1 qr., boxes, 2 qrs. 7 lbs.; (West India), packages (various sizes, same as mace); (Wild), packages, 2 qrs.

14. CONDIMENTS

In addition to ordinary Black, White, and Long Pepper there are a few other condiments to which the name "pepper" is often applied, but which strictly are not peppers at all. As examples

Mr. ALDERMAN W. IRELAND, J.P. of Dublin, is a grocer well known in Ireland and the Sister Isle, having for many years been a regular representative of his association in the councils of the Grocers' Federation. In 1902 he was elected president of the Irish Council of the Grocers' Association. He was one of the founders of the Dublin Family Grocers' Association in 1892; was elected its first president, and re-elected for a second year of office.

Bailie ADAM MORTON DUNLOP, well known in the grocery and provision trade of Glasgow, has been a member of the Grocers' Federation since its formation, and was president of that body when it met in Glasgow in 1895.

Mr. THOMAS GEORGE BISHOP, senior partner of Cooper & Co., was born in Carlisle in 1846, of Scottish parentage. He commenced business in 1871, trading as Cooper & Co., Tea Merchants and Grocers, and soon after assumed Mr. John Henderson, his brother-in-law, as a partner, with whom he has been associated ever since. Cooper & Co. have a very extensive Grocery business in Scotland, besides having similar large and successful businesses in Liverpool, London, and other English towns.

Mr. THOMAS CORDEY, of Newport, Mon., is the head of a large Grocery business in that town, and is one of the best-known grocers of South Wales. He entered the grocery business as a boy, and after a term as assistant with Morris & Pritchard he began business on his own account. Thirty years afterwards he became president of the Federation of Grocers' Associations of the United Kingdom, and since 1896 he has been a vice-president of that powerful body. He has taken considerable part in the municipal affairs of his town.

not only the most important but also the most profitable branch of the grocery trade. It is a branch which has of late years attracted much of the public attention, and it is one which is steadily increasing in importance. It is a branch which is becoming more and more a part of the daily life of the people, and it is one which is becoming more and more a part of the daily life of the people.

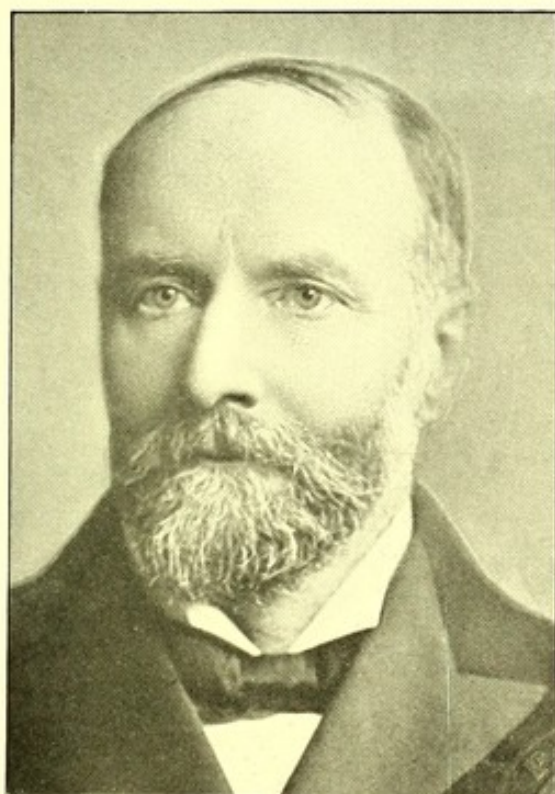
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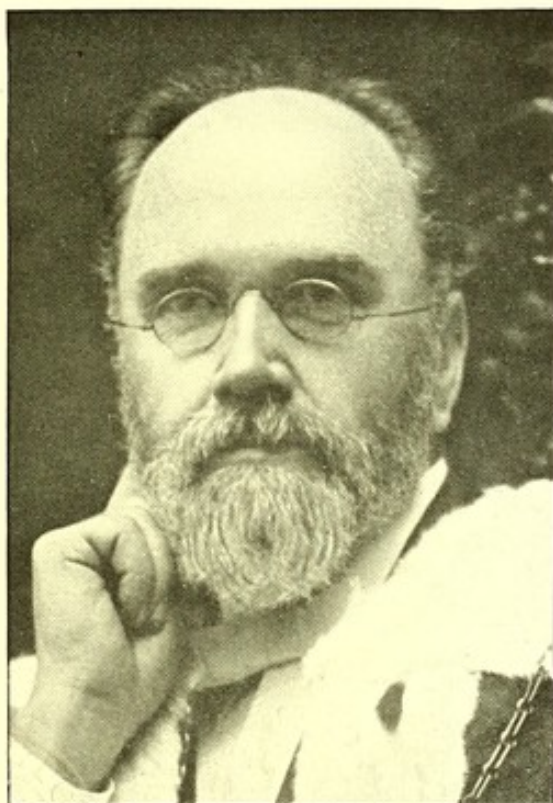
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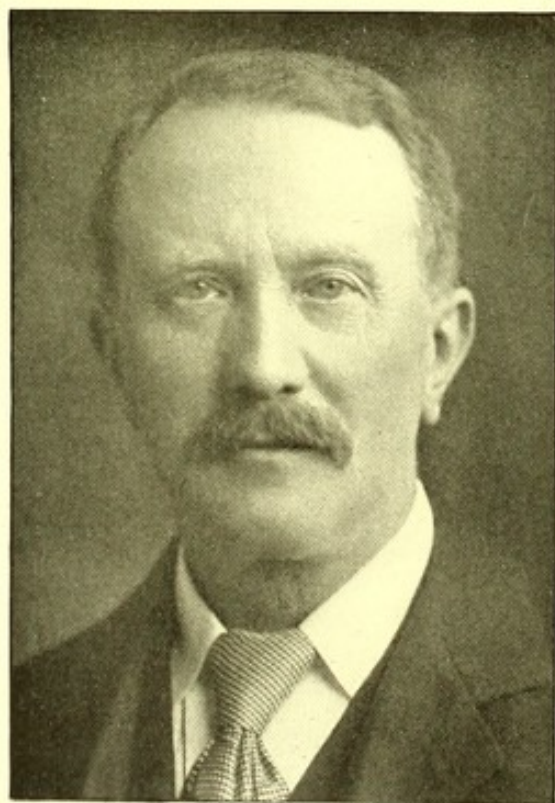
LEADING MEMBERS OF THE TRADE



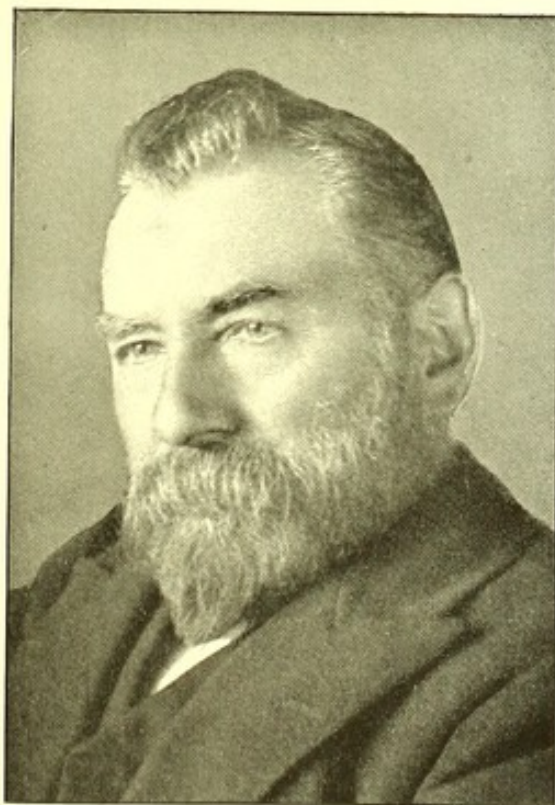
ALDERMAN W. IRELAND, J.P.



BAILIE ADAM MORTON DUNLOP



THOMAS G. BISHOP



THOMAS CORDEY



of these may be mentioned Red or Cayenne Pepper, Jamaica Pepper, and Melegueta Pepper.

Black Pepper, of which the chief varieties met with in commerce are known as Malabar, Aleppy, Tellicherry, Cochin, Penang, Singapore, and Siam, is the dried fruit of a climbing shrub known as *Piper nigrum*. The pepper-plant grows wild in South-western India, and the only method of cultivation adopted by the natives is to tie the climbers or vines to adjacent trees, clear away the underwood, and manure the roots of the plants with a heap of leaves. ^{About} **Black Pepper.** Where pepper does not grow wild, cuttings are planted and trained up to adjoining trees. The plants bear in the fourth or fifth year, and those raised from cuttings, which are said to produce the best kind of pepper, are fruitful for about seven years. In Sumatra the cuttings are planted about 5 feet apart, together with saplings to serve as supports when the shoots are ready for training. Two crops are gathered every year; the chief one, yielding pepper of better quality and in greater quantity than the other, being collected in December and January, the second one in July and August. The fruit is a small, round berry which grows in loosely-packed clusters, each cluster consisting of from twenty to thirty of these berries closely attached to a common pendulous fruit-stalk. Pieces of this fruit-stalk may often be found in samples of whole black pepper. The pepper vine grows to a height of 8 feet to 12 feet, and is usually supported by poles or trees. Black pepper is the dried immature berries. To obtain black pepper, the berries are gathered as soon as one or two on the cluster commences to turn red. After removing them from the stem they are dried in the sun or near a mild fire. By this treatment the outer fleshy portion of the berry shrivels, turns to a brown or black colour, and becomes quite hard and brittle and adherent to the stony, inner portion, thus forming a hardened wrinkled cortex. Many varieties of black pepper are dried on the ground; some of the berries become coated with earth therefrom. It has also been said that a good deal of the sand and clay found in some peppers is due to the trailing habit of the vine, which brings the pendulous clusters in close proximity to the ground. No pepper, however, should contain an excessive amount of dirt.

The commercial varieties of black pepper, as Singapore, &c.,

are named from the province of growth or port of shipment. "Shot black pepper", it is said, is sometimes prepared by floating in water, that going to the bottom forming the shot pepper, while the lighter portions are skimmed from the surface. This process has, however, proved to be injurious to the berry, and the pepper is now generally separated in a column of air. It is oiled to give it a better appearance (Michigan State Analyst's Report).

Mangalore peppercorns are very large, twice the size of ordinary pepper, of a deep, black colour, very clean, and of uniform size. When ground they give a powder of characteristic greenish-black appearance.

Singapore pepper constitutes a considerable portion of all the pepper raised, and by reason of its dark colour and fairly uniform quality is a good-looking pepper, but for grinding purposes it has not been heretofore so highly regarded, because of its smoky odour. Singapore pepper is dried over smoke. The pepper plantations and gambier plantations of Johore are usually under one management, and in boiling down the gambier to make the vegetable extract there are suspended over the kettle mats on which are placed quantities of the Singapore pepper. The smoke from the furnace dries the pepper, and at the same time blackens it and gives it the unmistakable smoky smell which is characteristic of Singapore pepper. This smoky odour is retained to a considerable degree even after the pepper is ground. It is one of the tests by which the pepper merchant determines whether a given sample is Singapore or not. Tellicherry and Aleppy peppers are very similar in appearance, being of light-brown colour. They are sun-dried. Trang pepper is shipped from Penang, and is grown in either Java or Sumatra. Lampong peppercorns are less uniform in size than the varieties above described, also of a lighter colour. Acheen, Sumatra, or West Coast are names applied to the pepper obtained from Acheen, the western extremity of the island of Sumatra. "The designations 'East' and 'West' coast, which were formerly used, have been lost track of, and the pepper is now designated according to its specific gravity, 'A', 'B', 'C', or 'D' grade."

The Malabar, Tellicherry, and Penang products are usually considered to be the best varieties of black pepper.

White Pepper is obtained from the same plant as black pepper,

the difference being in the preparation for the market. For the white kind the outer shell or pericarp of the berry is removed. This is not always done at the plantations, but may be done at a distance from them by manufacturers White Pepper. who buy the pepper in open market, merely selecting a lot which they deem suitable for the purpose. It is generally understood that berries that have been allowed to ripen before picking are used for making white pepper, as they are more easily decorticated, but not all white pepper is made from fully ripened berries. The shells are removed by friction after soaking the berries in water. The white peppercorns are often bleached and otherwise treated to improve their appearance. There are several varieties of white pepper on the markets, corresponding in a general way with the black peppers. Thus we have Singapore, Penang, Tellicherry, Siam, &c., but the white pepper from Tellicherry is considered to be the finest. According to Mr. A. H. Allen, "White pepper consists of the decorticated berries; and to meet the demand for a very light-coloured pepper the outer layers of the seed are sometimes ground off, the nearly white kernel alone being used. Such pepper contains a large proportion of starch, but is deficient in flavour and pungency." The term applied to it is "Decorticated white pepper", and there are various qualities according to the extent to which the decortivating or peeling has been carried. White pepper is milder than black, both for the reason just noted and because it is often allowed to become riper before being gathered, and some of the pungency is lost during the ripening.

Coriander white pepper is made in imitation of coriander by cutting from the end of each corn a piece of the outer hull, so that the dark-coloured inner portion shows.

A variety of adulterants are liable to be found in pepper. The mineral substances occasionally met with include *chalk*, *sand*, *clay*, and *barium sulphate*; these all increase the weight of the pepper-ash, and are in this way readily detected Pepper
Adulteration. when the quantity is not too small. Peppercorns are sometimes "bleached" with lime or clay, and samples have been met with which were sold in Mincing Lane as white pepper, but which really consisted of black pepper coated with a kind of whitish clay that did not rub off. It is stated also that at the weekly

spice sales in Mincing Lane quantities of "black pepper dust" have occasionally been sold which contained over 40 per cent of mineral matter, the presumption being that this "dust" was intended for grinding up with ordinary pepper. A mixture which has been much used for improving the colour of pepper consists of finely-ground *rice-starch*, *barytes*, *chalk*, and *chrome yellow*. This gives a yellowish tinge to the article, for which purpose turmeric is also sometimes employed. *Mustard husks*, *linseed-meal*, and *spent ginger* are some of the organic adulterants that have been used for purposes of sophistication. **Poivrette** or **pepperette** was also extensively used some time ago as an adulterant of pepper. It is a buff-coloured powder, and consists of ground *olive-stones*. An easy method of detecting poivrette is to mix the sample of pepper into a paste with weak caustic soda, dilute the paste with a considerable quantity of water, and decant off the liquid. After washing the residue in the same way with a further volume of water, the particles of poivrette in the residue will appear of a bright-yellow colour, and can be picked out and tested to see if they are hard, as they should be if poivrette. *Ground rice* is probably the most frequent starchy adulterant of pepper.

The commercial value of pepper depends a good deal upon the weight of the peppercorns, and merchants are accustomed to appraise samples by judging the weight of a number of corns taken up in the hand. Malabar pepper is generally considered the heaviest, though some specimens of Penang have been found to be even heavier than average Malabar. As a rule the weight of 100 berries lies between $3\frac{1}{2}$ grammes and 6 grammes; the lower figure was found by Mr. W. Johnstone for a sample of Lampong pepper, and the higher by Dr. A. W. Blyth for specimens of Malabar and Penang. The corns of good black pepper should be firm and round, with a skin not too much furrowed. When rubbed between the palms the berries should not readily crumble. Since the specific gravity of the corns is greater than that of water, they readily sink when thrown into a glass of this liquid.

Ground Pepper for retailing is almost invariably a blended mixture of several kinds. A common mixing consists of equal parts of Malabar, Penang, and Sumatra peppers; the first is

to give weight, the second strength, and the last colour. It should be nothing but black or white pepper ground to fineness.

One or two rough tests for artificial colouring matter in pepper may be mentioned. (1) Steep the suspected pepper in water for several days, and notice if the water becomes coloured or turbid. (2) Stir up a little of the sample with a little pure dilute hydrochloric acid, and note whether the liquid acquires a red or yellow tinge. (3) Notice whether the colour of the pepper fades after being kept in stock for a time.

When any considerable quantity of *long pepper* is mixed with ordinary ground pepper the mixture has a peculiar slaty colour, and the characteristic odour of the long pepper can be readily recognized after a little experience.

Long Pepper is the fruit-spike of the plant *Piper officinarum* (or *Chavica Roxburghii*), gathered shortly before the fruit reaches maturity, and dried for the market. The plant is a native of the East Indies, occurring in one variety or other in Java, Sumatra, Ceylon, Malabar, Eastern Bengal, Timor, and the Philippines. The pepper does not consist merely of the berries analogous to the peppercorns of the true pepper plant. It is a dense spike of small berries closely packed round the central stalk, the spike being about an inch and a half long and a quarter of an inch thick. In Bengal the plants are propagated by suckers, which are planted about 5 feet apart in dry rich soil on high ground. The fruit is usually collected in January. Much of the long pepper is, however, derived from wild plants.

As met with in commerce the spikes with their berries appear as compact masses, which look as though they have been limed. The pepper is always contaminated with from 3 to 7 per cent of clay and sand, embedded in the crevices of the fruit. It is therefore almost impossible to properly clean the long pepper before grinding it, as is readily done with true pepper.

Long pepper contains piperine, resin, albuminoids, starch, and volatile oil; and yields from 8 to 10 per cent of ash. The quantity of piperine is smaller than in ordinary pepper, and the volatile oil has a strong and disagreeable smell. On account of this smell the article can hardly be used by itself, and its chief application is in the making of pickling-spice. In the ground, unmixed state it can scarcely be said to be a recognized trade article; and as it

Testing
Pepper.

Long Pepper
and Others.

is usually lower in price than the ordinary pepper, its admixture with the latter is of the nature of an adulteration.

Penang and Singapore are the principal centres in the East for the distribution of long pepper.

Elephant Pepper is a large variety of the long pepper just described.

Nepaul Pepper is a superior kind of cayenne, which see. It is prepared from a variety of capsicum, the best quality being ground in Nepaul.

West African Pepper, or *Ashantee Pepper*, is the dried fruit of a plant (*Piper Clusii*) widely distributed in tropical Africa. It differs from ordinary black pepper chiefly in being somewhat smaller and less wrinkled; moreover it is attenuated into a stalk like cubebs, to which it bears considerable external resemblance. The taste, however, is pungent like that of pepper, and the fruit contains piperine. It is extensively used in tropical Africa.

Paprika, or Hungarian Red Pepper, much esteemed in Hungary, is a non-pungent condiment prepared from a variety of capsicum.

Jamaica pepper is *all-spice*, and not a true pepper.

Melegueta Pepper or "Alligator Pepper" is likewise not a true pepper, but is derived from a plant of the ginger family, *Amomum Melegueta*. It is known also as "Guinea grains" and "grains of paradise". The seeds are extremely pungent, and are used as a spice throughout Northern and Central Africa.

Cayenne Pepper, which is also known as "red pepper", "Guinea pepper", and "Spanish pepper", is derived from a genus of plants totally distinct from the Pepper group. It is a preparation from the dried fruit of various species of **Capsicum**, a genus of the natural order *Solanaceæ*, which furnishes also the potato, tomato, and bitter-sweet. The capsicum plants have a greenish-white flower, and on ripening, the ovary of the plant becomes eventually a leathery pod, within which are the spongy pulp and several capsicum seeds. For the most part the capsicums are natives of Brazil, the East and West Indies, and China; but they are now grown both as ornaments and for fruit in various parts of the world.

Cayenne pepper is prepared either by simply drying the pods and pounding them fine in a mortar, or else by further treatment of this ground material. In the latter case the pounded substance

is mixed with wheat-flour and made into cakes with yeast; the cakes are baked until hard like biscuit, and are then ground and sifted. The flavour of the cayenne deteriorates by exposure to damp and the heat of the sun. The pungency of cayenne pepper is entirely due to a certain oil and resin which it contains, and which can be extracted by treatment with ether. After such extraction the residual powder is nearly or quite tasteless. Red-lead, iron, ochre, vermilion, salt, ground rice, and turmeric have been occasionally found as adulterants of cayenne. At the present time they only occur rarely, and some of them probably not at all. About 10 or 11 per cent of ether-extract is yielded by commercial cayenne peppers when analysed, and 5 or 6 per cent of ash. Medicinally, cayenne pepper is used with cinchona in lethargic affections and in some forms of dyspepsia. The so-called "tincture" of cayenne is made by boiling two table-spoonfuls of powdered chillies and a tea-spoonful of salt with a pint of vinegar, and then straining the liquid from the residue.

Chillies are the dried ripe or unripe fruit of capsicum plants; and, more especially, are a small variety of capsicum derived from the species *Capsicum frutescens*. They are consumed largely by the people of Guiana and other warm countries. In Europe they are chiefly used as a spice and for making chilly-vinegar, but they find a certain application in medicine as well. The "small red chillies" of *C. frutescens* are barely an inch long, and of a deep-orange colour. They are hotter and have more aroma than other species of capsicums. The hot and biting taste of chillies is said to be due to the presence in them of an alkaloid termed "capsicine"—a reddish body having an extremely irritating and acrid odour. Chillies are chiefly imported from the West Indies and from Zanzibar. The name itself is of Mexican origin.

Bird's-eye chillies are a very small, red kind, of superior quality.

There is no fundamental difference between **capsicums** and chillies. In fact both these names, and some others, such as "red pepper" and "cayenne pods", are often used indiscriminately to indicate any of the varieties of capsicum fruit. But whereas "chillies" usually means more especially the small kind of capsicum referred to above, the term "capsicums" is more general, and includes the larger sorts of

Chillies and
Capsicums.

pods more particularly. "Capsicums", in fact, are the dried fruits of several species of plants—all, of course, belonging to the genus *Capsicum*—the best-known varieties of which are *Capsicum fastigiatum*, *C. annuum*, and *C. grossum*. The last-named yields a favourite kind of capsicum, and its fruits are the best kind for pickling purposes, since their skin is tender, instead of being thin and tough like that of other sorts of capsicum. Each pod encloses about a dozen kidney-shaped seeds.

In the south of India capsicum plants grow wild, and capsicums form the principal condiment used by the natives. Large quantities are eaten in the green state, but some are pickled, and others enter into chutneys and curries. When ripe they are either dried in the sun or else packed in brine for exportation; their chief use in England is for seasoning mixed pickles, sauces, &c. When dried and ground they form cayenne pepper.

WEIGHTS of PEPPERS on the wholesale market are:—Pepper, black, bags, 1 cwt. to 1 cwt. 1 qr.; white, Singapore, &c., bags, 1 cwt. 1 qr.; white, Tellicherry, cases and bags, 1 cwt. 2 qrs.; pod, Zanzibar, bales, 1 cwt.; pod, capsicums, Natal, bales, 4 cwts.; pod, Bombay, bales, 1 cwt. 1 qr.; Sierra Leone, bags, 3 qrs.; long pepper, bags, 1 cwt. 14 lbs.; cayenne (four tins in case), cases, 1 cwt.

Ordinary table Mustard is the yellow flour or farina obtained by grinding mustard-seed and separating the husk. It was originally known as "Durham Mustard", a lady of that town having introduced the ground form of the article to public notice. Frequently, however, the mustard is not the flour only, but is compounded into a "mustard condiment" by mixing with wheat or other farina and colouring with turmeric. This, of course, should be sold as a mixture, not as pure mustard. The plants which furnish mustard-seed belong to the genus *Brassica* (*Sinapis*). There are three principal species, the Black or Brown Mustard (*Brassica* or *Sinapis nigra*), the White Mustard (*Brassica alba*), and the Sarepta Mustard (*Brassica juncea*), this latter being more especially grown in Russia and in the East Indies. The eastern counties of England are noted for producing the finer qualities of Black and White Mustards. Of these the former is the more valuable for commercial purposes, though it requires good soil and careful treatment during the growth of the plant. Its seeds

are of a brownish-purple colour, and are very much smaller than those of white mustard. The seeds in one gramme weight of Yorkshire white mustard were counted by Messrs. Piesse & Stansell, and found to number 170, and in Cambridge white mustard 172; whereas in the same weight of Cambridge brown mustard there were 944 seeds.

In the manufacture of mustard the mixed seeds of both varieties—*i.e.* Black or Brown, and White—are first crushed between rollers and then pounded in mortars to sub-

Mustard
Manufacture.

 divide the mustard-substance and release it from its attachment to the fibre. The pounded seeds are then sifted through a coarse sieve. The residue left on the sieve is termed "*dressings*" or "*siftings*", that which passes through is "*impure flour of mustard*". This latter then undergoes a second sifting through a finer sieve, yielding thereby a second quality of "*dressings*", and "*pure flour of mustard*" which constitutes the ordinary mustard farina of the shops. By means of pressure a quantity of "fixed oil of mustard" is extracted from the dressings and is used for various purposes, such as mixing with rape, colza, and other oils. This fixed oil is more fully described further on. A mixture of both black and white mustard is better than either kind separately, for the following reason:—The peculiar pungency and odour to which mustard owes much of its value are due to an essential oil developed by the action of water upon two chemical substances in the mustard, called *sinigrin* and *myrosin* respectively. The former is contained in black mustard, but not in white. The latter, myrosin, is a kind of ferment, which, when the mustard is mixed with water, reacts upon the sinigrin and forms from it the essential oil referred to. Now, black mustard does not contain enough myrosin to attack all its sinigrin, whereas white mustard contains an excess of myrosin. Hence, in a mixture of the two, the white mustard supplies the myrosin which is deficient in the black; and from this it follows that a greater yield of the essential oil is obtained from a mixture of the two than from either alone. It is for this reason that the Pharmacopœia prescribes the use of both black and white mustard-seed (ground) in the making of mustard plasters: the mixture is more pungent than the one ingredient alone. It is worthy of remark that the above reaction does not take place if *boiling*

water is used, and hence very hot water should be avoided in mixing mustard.

Several grades of *pure mustard* are made containing nothing but the farina of mustard-seed, the lower qualities having larger amounts of the cheaper white mustard. The **Pure Mustard and Mixtures.** various kinds are distinguished as "pure genuine", "extra quality genuine", "superfine", "double superfine", and so on.

Compound Mustards.—As regards the mustard mixtures, these are sold as "mustard condiment", "compound mustard", or under some fanciful designation. The *pros* and *cons* of the matter in respect of such mixed mustards are as follows:—Wheat-flour or other starch-flour mixed with mustard softens the sharpness and bitterness of flavour met with in the pure article. It appears, moreover, to be an established fact that the addition of about 10 per cent of wheat- or rice-flour to the finer qualities of table mustard, especially such as contain a large proportion of the "black" product, materially improves the keeping qualities of the article, both in the dry state and when mixed with water. Such pure mustard, when shipped to warm climates, and in some degree also when kept in warm shops here, is liable to turn dark in colour and to become lumpy. In other words, for table purposes it deteriorates in quality. Even irrespective of this, it is quite possible for a mixed mustard, if it does not contain too much flour, to be superior to a pure mustard, because the latter may consist mainly of the farina of white mustard and hence be of very poor quality.

On the other hand, wheat-flour or other starch-flour is not really necessary as a preservative—at all events as far as this country is concerned. The fact that some manufacturers do not use it at all, and that most houses supply the unmixed mustard as well as the compound, shows that wheat-flour and turmeric are not indispensable ingredients. Hence under the Sale of Food and Drugs Act it is made an offence to sell, without disclosure, any mustard to which wheat-flour or other diluent has been added. But the sale is legal if the addition is duly announced by label.

The principal constituents of pure mustard are a *fixed oil* ("fixed oil of mustard"), which forms about one-third of the

weight of mustard farina; albuminous bodies or *proteids*, equal to about one-fourth of the weight; the ferment *myrosin*, already mentioned; two substances termed *glucosides*, of which one, "sinigrin", has been already noted as being contained only in the black mustard-seed, and the other, "sinalbin", is present only in the white mustard; and a body called *sinapine thiocyanate*, which is contained in both the black and the white seed, but in much larger proportion in the latter than in the former. Besides the above, there are always certain quantities of *fibre* or *cellulose* and *mucilage*, *moisture*, and mineral matter or *ash*. Neither kind of mustard contains naturally any starch.

Mustard Oil.—The "*fixed oil*" must not be confused with the volatile or "*essential oil*", which, as has been explained already, does not pre-exist in the mustard, but is produced by the aid of the ferment when the mustard is mixed with water. The "*essential oil*" is very pungent and of characteristic odour. The "*fixed oil*", of which the seeds contain about 25 to 30 per cent and the table-mustard about 35 per cent, is a bland, inodorous, yellow-coloured or nearly colourless oil, quite free from pungency. It has little tendency to become rancid. In India it is largely used for cooking and all ordinary purposes, and it is a regular article of commerce with oilmen in this country—as is also the "*volatile*" oil of mustard.

Mustard Leaves.—The mustard leaves, plasters, or "*sina-pisms*", now commonly used as rubefacients and vesicants in various ailments, are made by extracting all the fixed oil from a mixture of black and white mustard-flours by means of ether or benzol, and then attaching the dry mustard-powder to muslin or cambric.

The following analyses show the average amounts of the chief constituents ordinarily present in commercial mustard:—

	Brown Mustard.			White Mustard.		
Moisture	4.8 per cent.		5.4 per cent.	
Fixed oil	35.7 "		35.8 "	
Sinigrin	4.8 "	Little or none.		
Sinapine thiocyanate	3.6 "		11.0 "	
Myrosin and proteids	29.5 "		27.5 "	
Cellulose, mucilage, &c.	16.8 "		16.3 "	
Ash	4.8 "		4.0 "	
			100.0		100.0	

The gross sophistications of former days included such substances as chalk, sand, calcium sulphate, and chrome yellow; but, at least in this country, it is rare at the present day to find adulterants of this kind. A colouring-matter derived from coal-tar, and termed Martius' Yellow, has several times in the last few years been found in mustards of French, German, and American origin; in England, however, turmeric is the colouring usually employed. It is detected by means of the microscope. *Cayenne pepper* or capsicum has often been used to make diluted mustard more pungent. A simple method of detecting this is to boil a little of the mustard—about half a teaspoonful—with about a table-spoonful of methylated spirit for a minute or two. The liquid is then filtered from the mustard by pouring it through a small filter of blotting-paper, received in a small basin or tea-cup, and evaporated to dryness on a steam-bath. (A tea-kettle does very well for this, the basin being placed on it instead of the lid; but care must be taken not to let the spirit ignite.) On tasting the residue the pungent, biting flavour of cayenne will readily be detected, if that adulterant was originally present in the mustard. *Wheat-flour* and *rice-flour*, with turmeric to heighten the colour, are the most usual additions to mustard in this country. As already explained, they are not adulterants if the mustard is sold as a mixture. Even in this case, however, excessive amounts have been objected to, though there is no actual standard. *Charlock-seeds* and *rape-seed* have been used instead of true mustard-seed: these additions are detected by microscopical tests. Mr. A. H. Allen, the Public Analyst for Sheffield, mentions one or two interesting cases of mustard adulteration. In one instance it was asserted that calcium sulphate (plaster of Paris) had been used with so free a hand as to cause the mustard to "set" when mixed with water. In another case a firm of mustard makers who were in financial difficulties, and unable to obtain mustard-seed on credit, are said to have carried on their business for months by manufacturing "mustard" from a mixture of rape-seed, wheat-flour, turmeric, and cayenne pepper.

Salt, or Sodium chloride.—This indispensable condiment has been known in all ages. Immense deposits of it occur in various parts of the world; and it has been calculated that dissolved in

the ocean there are nearly $4\frac{1}{2}$ million cubic miles of solid sea-salt, or about fourteen times the bulk of the entire continent of Europe above high-water mark. The largest salt-mines in the world are in Galicia, and belong to the Austrian Government. In this country table-salt is chiefly obtained by the evaporation of brine in large shallow iron pans; in Germany, where the brine-springs are usually much more dilute than those worked in England, the evaporation is partly conducted by the action of the wind. The water of the spring is allowed to trickle over a stack of brushwood freely exposed to the air, and after several repetitions of this the solution is sufficiently concentrated to be economically boiled down in pans. The chief centres of salt manufacture in England are at Northwich, Middlewich, Winsford, and Sandbach in Cheshire; Weston-on-Trent in Staffordshire; Stoke Prior and Droitwich in Worcestershire; and Middlesboro' in Yorkshire. For the most part the salt in this country occurs in the Keuper marls of the Triassic formation. The Marston mine at Northwich is the largest and probably the oldest, having been worked for about 230 years. One bed of rock-salt in this mine, which has been in working for over a century, is about 35 yards thick. On the top of the salt-beds, and apparently lying in recesses of their surface, is a layer of saturated brine containing about 25 per cent of salt; this is the brine which is raised at the various pumping-stations in the salt districts, and which serves, when evaporated, to produce white salt. The rock-salt itself is blasted out with explosives.

Four principal kinds of salt are manufactured from brine in this country. They are as follows:—**Fine-grained or Lump Salt.**—This is made in the smallest-sized pans, about 30 feet long, 20 wide, and $1\frac{1}{2}$ deep. The brine is boiled till a temperature of $107\frac{1}{2}^{\circ}$ C. is reached. As the salt forms it is raked to the side of the pan, and is drawn out two or three times in twenty-four hours by means of a perforated shovel or "skimmer". The salt, with some adherent hot brine, is placed in wooden boxes as it is ladled out, and as it cools in the boxes the hot brine crystallizes, cementing the whole into a solid mass. The lump-salt thus formed is dried, crushed, and ground to form the fine table-salts. **Common Salt** is salt of the particular grain used in various manufacturing operations. To produce it the brine is evaporated

Manufacture
of Brine Salts.

more slowly, at a lower temperature, and in larger pans than are used for the fine-grained salt. **Fishing-salt** is a coarse-grained kind made for the fish-curing trade, still lower temperatures and larger pans being employed. **Bay-salt** is the coarsest-grained salt manufactured. The evaporation of the brine is conducted very slowly, the temperature being only a few degrees above that of blood-heat, and very large pans—up to 140 feet long—are used. The salt is only drawn about once a month. The exact grain of salt required can also be obtained by what is technically known as “poisoning” the pan, instead of graduating the evaporation. Thus, fine crystals are caused to form if a little gelatine, glue, or grease is added to the brine, whereas larger grains are given by the addition of alum. The total output of salt in the United Kingdom is about two million tons per annum, of which approximately one-tenth is rock-salt. Of this latter Ireland produces about 30,000 tons.

The Sicilian salt industry was started at the beginning of the sixteenth century (1507), when King Ferdinando granted to the Prince of Paceco all the foreshore from Marsala to Trapani for the purpose. The salt-works occupy an area of about 10 square kiloms. and nearly all the shore from Trapani up to the gates of Marsala. The works are all private property; the Government monopoly, which is strictly enforced in all Continental Italy, does not exist at Trapani or elsewhere in the island of Sicily.

The process of making salt in Sicily is very primitive, but owing to the settled state of the climate during the months of July, August, and September, and also to the purity of the sea-water, the yield is, with rare exceptions, very abundant. The best conditions for making salt are dry and clear weather, accompanied by a light breeze; the wind, by agitating the surface of the water, greatly helps the precipitation of the salt to the bottom of the pan and the evaporation of the water. All the area of a saline is occupied by pans, except a small space for a house and stores. The pans are employed for various uses, and in a well-constituted saline must occupy no more than one-seventh part of the whole area. Other pans are destined for preparing the waters, which operation is a constant care during the whole year. When the water is first taken from the sea, it is passed into a pan called “Fredda” (cold), and then gradually passes into other pans until it is collected into

another pan called "Calda" (warm). The meaning of these two words is that at first the water contains very little salt, about 5 degrees, and then, by the effect of the evaporation, it becomes more impregnated, containing less water and more salt, and when it reaches the "Calda" the temperature is 30° or 35°, and then it is ready for making salt, and when the proper season comes, with a large quantity of this water ready, a few days are enough to do the necessary work and obtain the product.

The salt-pans are quadrilateral in form, measuring about 30 yards square; each side is 15 inches high; the bottom or bed may be of mud or sand; the oldest pans have always a mud bottom, but it is so hard that a man can walk on it without leaving any trace of his steps, and water will not be absorbed by it. The system of making sand bottoms is relatively recent, the first trials having been made not more than fifty years ago, and since then the transformations have always increased every year. When the salt is made on sand-bottomed pans the salt produced is, of course, much cleaner and whiter, but it always contains a little sand. It is generally admitted that the older a saline is the better is the quality of the salt produced, and this is due to the bottoms of the pans, which must be hard and well consolidated. All salines are provided with windmills, which are used for passing the water from the sea into the pans, and also for grinding the salt. When the salt is made, and no more water is left in the pan, the men proceed to collect the salt in small heaps, each one corresponding to the contents of six large baskets, and in this way it is left to dry for about twenty-four hours; then it is removed from the pan and piled up in a square heap, which as soon as possible is covered with tiles to preserve the salt from rain and dust. Each heap may contain up to 300 tons of salt. All the salines are divided by channels, which give access to the lighters on which the salt is shipped. A salt-pan gives three, four, and sometimes five crops during the season, which is considered finished when rain commences in the autumn, and when nights are becoming so long and so damp that the progress obtained during the day is counteracted during the night. There are at Trapani three qualities of salt. (1st) First quality fine-grained Trapani salt; (2nd) First quality coarse-grained Marsala salt; and (3rd) Best ground marine salt. It is said that the position of the pan

The Trapani
"Salines".

causes the salt to be made of fine or coarse grain, and that no special treatment is used to that end. The salt is exported to Norway and Sweden, Finland, United States of America, Newfoundland, Nova Scotia, Canada, and other countries, and is principally employed for curing or salting fish.

15. SAUCES

SAUCES may be defined as fluid or semi-fluid condiments used for imparting relish to food. They are distinguished from gravies by their basis being composed of some such substances as soy, milk, cream, butter, gelatine, bouillon, or other non-pungent ingredients; to which basis various flavouring materials are added in order to form the sauce. Putting aside the various sweet sauces, and others which are rarely or never articles of sale with the grocer, there still remains an almost endless variety of preparations made from such materials as tomatoes, mushrooms, onions, anchovies, walnuts, raisins, tamarinds, and horse-radish, mixed with more or less sugar, treacle, butter, flour, vinegar, &c., and flavoured with spices to suit individual tastes.

As regards their utility, it may be remarked that in addition to adding zest or relish to food, sauces may play other parts in the matter of diet. Certain sauces in which strong spices predominate are valued for their stimulant properties; others, having acid reactions, exert a solvent influence on some kinds of food; and such as are fatty or contain butter may be useful with eatables in which fat is deficient.

Naturally there is room for a good deal of quackery in the compounding of sauces. Some are wholesome and useful for the reasons just mentioned; others are harmless if not particularly useful; and probably few are really deleterious, considering the small quantity usually consumed at any one time. But the quality of a sauce is literally a matter of taste; there are no canons or standards except the individual palate, and little definite guidance can be given to the grocer beyond recommending him to consult his customers' preferences, and not to stock too much of any brand until he has proved that it will sell. The following notes, however,

will give an idea of the materials and methods used in making sauces.

Soy.—The foundation of many or most of the commercial sauces and relishes is the preparation known as "Soy". It is largely manufactured in China, and an imitation soy is also made in England. The Chinese product is obtained from the fermentation of the Soy bean or Soja bean (*Soja hispida*), which is common in India and the Far East. These beans are boiled to soften them, mixed with ground wheat or barley, salt, and other ingredients, and then allowed to ferment for several weeks. The liquid is eventually strained off and allowed to clarify on standing. Treacle or molasses is frequently added. The soy finally obtained is a syrupy, dark-brown, clear liquid, which should not be too salt or too sweet. Rather considerable quantities are imported, and a customs duty of 1s. per cwt. is at present levied upon those kinds which are made with molasses. **English Soy** is a mixture of treacle or molasses and salt, with sometimes a little water. A superior kind is said to be made by gently heating together 2 gallons of malt syrup, $\frac{1}{2}$ gallon mushroom juice, 10 lbs. treacle, and 9 lbs. salt. These are stirred until thoroughly mixed, and allowed to stand for two or three weeks, after which the clear liquid is siphoned off from the sediment. We may quote the following recipe for Worcester sauce as an illustration of the use of soy in sauce-making.

Worcestershire Sauce.—Recipes for various sauces, including Worcestershire, will be found in most cookery-books. The following is said to be a superior article, and it is fairly typical of good commercial Worcester sauces: Take as materials $2\frac{1}{2}$ gallons malt vinegar, 3 quarts soy, 1 quart common lime-juice, 1 lb. eschalots or onions, $\frac{1}{2}$ lb. garlic, $2\frac{1}{2}$ lbs. tamarinds, $\frac{1}{2}$ lb. anchovies (or two pickled herrings), 4 ozs. red chillies, and 4 ozs. ground cloves. Boil all these ingredients together for about twenty minutes, then strain through a fine hair sieve, and when cold add a few drops of essence of lemon. The garlic and eschalots should be peeled and bruised, and the fish cut in pieces; and the contents of the pan should be gently stirred throughout the heating to prevent settling and burning.

"**Leicester Sauce**" is a sauce with good reputation. It is of the same general character as the Worcester, but richer and less

pungent. "**Cambridge Sauce**" or "**Sharp Sauce**" is an example of a different kind of preparation. It consists of a purée of anchovies, capers, parsley, and eschalots, with hard-boiled egg-yolks, the whole being flavoured with spices, oil, and vinegar.

Another class of sauces are those which have for their basis a brown stock of cooked flour and butter, mixed with meat broth or bouillon. The stock is the parent substance of a number of brown sauces. In sauce-making establishments it is prepared in quantity, and then divided into portions for the different sauces required for the day's packing; the various kinds being obtained by mixing with the stock the proper proportions of bouillon, appropriately flavoured and seasoned. The following examples illustrate the mode of procedure.

Brown Stock is made by melting flour and butter, in the proportions of 1 lb. of the former to $1\frac{1}{4}$ lb. of the latter, over a slow fire with constant stirring until the mixture has acquired a good brown colour. During this process the flour is partly converted into dextrin. **Brown Sauce** (plain) is obtained by slowly adding to the above stock $1\frac{1}{2}$ quart of meat bouillon for every pound of flour taken, and then, when this is thoroughly mixed in, another $7\frac{1}{2}$ quarts of the bouillon. The whole is boiled slowly for half an hour and skimmed occasionally. To this plain sauce different spices may be added to give various other sauces.

Madeira Sauce is made from the brown stock by adding *flavoured* bouillon in the same proportions and in the same manner as for the plain brown sauce. The flavoured bouillon is prepared by mixing 3 quarts of Madeira wine, 2 ozs. of sugar, and the juice of 5 lemons with 30 quarts of simple bouillon.

Sauce Piquante is made in the same way, the bouillon being flavoured with vinegar, eschalots, and garlic. After it has been strained and mixed with the brown stock, as above described, the resulting sauce is further flavoured with mixed spice, lemon-juice, chopped vinegar-pickles, and capers.

Tomato Sauce is an example of a thick sauce. One method of preparing it is to mix crushed tomatoes with about 3 per cent of their weight of onions and 1 per cent of salt, boil the mixture for two hours, season with bay-leaves and cloves, and then press the pulp through a metal sieve.

Many of the bottled sauces are kept from turning bad by

heating the bottles, after filling, to the temperature of boiling water or higher, and sealing them air-tight.

Ketchup (Catchup, Catsup) should perhaps in strictness be nothing but the juice which exudes from salted mushrooms, boiled and flavoured with spices. The name has, however, long covered a variety of preparations, not only from mushrooms, but from walnuts, tomatoes, oysters, &c.; and even in the case of mushroom ketchup the pure juice is often diluted with water, whilst the mushrooms are sometimes more or less replaced by boiled liver. The name "ketchup" is said to be of Eastern origin, and to come from the Japanese "kitjap", a word denoting a similar condiment. No doubt the original reason for the use of mushroom was very much what was given by Dr. How Ketchups are Made.

Kitchener, a writer of a former generation, who says: "Mushroom gravy approaches the flavour of meat gravy more than any other vegetable juice, and is the best substitute for it in meagre soups and extempore gravies". On the other hand, it may be pointed out to the disadvantage of mushrooms that the use of mushroom ketchup is not altogether unattended with danger, if proper care be not exercised in the selection of mushrooms free from other fungi. Some of the chief varieties of ketchups usually sold are, besides mushroom, the following:—Walnut, tomato, oyster, camp, cucumber, marine, and pontac. To illustrate the production of these it will suffice if one or two of the chief kinds are briefly described.

Mushroom Ketchup.—Carefully-assorted mushrooms are sprinkled over with half their weight of salt, and allowed to stand about twenty-four hours. The juice which exudes is then strained off, mixed with spice as desired (*e.g.* for each pound of mushrooms taken use 1 oz. ground pimento and $\frac{1}{4}$ oz. ground cloves), and then boiled for some time, after which it is ready for bottling.

Ketchup which has not been "processed" after bottling—that is, which has not been heated with steam to destroy moulds and bacteria—is liable after a few weeks to acquire a bad flavour. When this occurs, and provided it has not gone too far, the ketchup may be boiled again with the addition of a little more pimento.

Tomato Ketchup.—The tomatoes are crushed, boiled, pressed through a sieve, and boiled again till they form a thick pulp.

Then salt, sugar, and special mixed spices are added, together with vinegar in which chopped eschalots have been boiled. The whole mixture is then again boiled for a short time, bottled hot, sealed air-tight, and "processed" in boiling water.

Curry-powders usually contain turmeric, ginger, coriander, cardamoms, caraways, black and red peppers, and cloves. Some contain also mustard-seeds, poppy, and cumin; and to others pounded lychees are added, which impart sweetness.

Curry-pastes are made by mixing some one of the above curry-powders with sugar or pounded raisins, lemon- or lime-juice, and vinegar or red-currant jelly.

16. PRESERVES

The group of table-delicacies which the grocer deals with under the collective designation of "**preserves**" includes—for our purpose here—such products as bottled fruits; candied fruits, fruits in syrup, jams, marmalades, pulps, and jellies. As a rule the articles are such as have been preserved in, or at least sweetened by, either sugar or syrup; but this is not invariably the case, since many bottled fruits are preserved in water only. Indeed the term "**preserves**" itself is used in varying and even in opposite senses. Sometimes it is employed as synonymous with jams and fruit jellies; and sometimes it is used, in contradistinction, to denote more especially the fruits which are preserved either whole or in slices. For present purposes the group is most conveniently subdivided as follows:—

- (1) Preserved uncrushed fruits.
- (2) Fruit pulps and juices.
- (3) Jams.
- (4) Jellies.

Of **PRESERVED UNCRUSHED FRUITS**, the crystallized or candied fruits have been elsewhere described in connection with the sugars

Modern Preserving. Before dealing with the remaining fruits, it is desirable to devote a few words to the underlying principles of modern food-preserving. The remarks will apply substantially unaltered to all kinds of food; but here we, of course, have more

especially in view the preservation of fruit. To begin with, it may be remarked that all putrefactive changes in food are due to micro-organisms. These latter are present in the atmosphere, particularly in that of inhabited or crowded places; and no food-substance can be exposed freely to the air of ordinary rooms, even for a few minutes, without at least running great risk of some of these organisms falling upon it. Suppose, for example, that there are taken into a shop or warehouse two covered plates of specially-prepared jelly such as is used by bacteriologists, both these plates having been freed from all living organisms by proper heating. And suppose, further, that one of the two plates is there uncovered so as to expose the jelly to the air for a quarter of an hour or so, and then covered up again. It will be found in a few days that the two plates show very marked differences in their appearance. The one which has not been uncovered will remain perfectly unaltered; the other will be dotted and blotched over with little white, red, or yellow patches; its previously-solid jelly will now probably be more or less liquefied, and the plate will most likely give off a disagreeable odour. Under the microscope the white or coloured dots will be seen to be made up of millions (literally millions) of bacteria—the dots and patches are, in fact, “colonies” of these organisms. Each “colony” marks the spot where at first a single germ fell from the air on to the jelly. Where it fell, there it lay; and there it increased and multiplied by “feeding” upon the substance of the jelly. Interspersed among the colonies of bacteria will almost certainly be found on the exposed plate some fluffy, woolly-looking patches: these are moulds and yeast-fungi, which are also present in the air.

Now, the same thing occurs with any food-substance which is exposed to the air, provided that it is, as most food-stuffs are, a favourable medium for the growth of the micro-organisms. Either bacteria fall in it and cause it to putrefy, or moulds overrun it, or yeast and such like ferments set up in the substance a state of fermentation. Hence, in preserving such “perishable” articles of food it is necessary, first, either to destroy all those living germs that may have already fallen on it, or at least to prevent their further development; and second, either to prevent any further access of micro-organisms to the article, or else to destroy them as they arrive.

To attain the objects just indicated four principal methods are employed:—(1) The food-stuffs are treated with preservatives such as borax or boracic acid, formalin, and salicylic acid. (2) Semi-preservatives, like acids, spirit, salt, and sugar, are used. (3) The micro-organisms, though not destroyed, are prevented from developing by refrigeration and cold storage. (4) The micro-organisms are destroyed by heat, and further access is prevented by sealing the vessels containing the food-stuffs so as to avoid contamination with the external air. It is this last method, the method of "sterilization", which is resorted to in the preservation of nearly all bottled and canned articles that are to be stored for long periods. In the case of fruits it is largely supplemented by the use of sugar, and also to a small extent by the employment of preservatives like salicylic acid in certain particular cases.

"Sterilizing" Bottled and Canned Fruits.—Each kind of micro-organism has its own "thermal death-point", or temperature at which its vital powers are destroyed. A few are extraordinarily resistant; but in practical fruit-preserving it is found that a temperature of 170° F. suffices to destroy all ordinary bacteria, mould-spores, and other fermentative bodies. It is necessary, however, after the vessel has been sealed air-tight, to submit it to such a temperature, and for such a time, as to ensure that *every particle* contained in the vessel is heated to at least 170°.

When the whole contents of the bottle or can are a light liquid, like plain fruit-juice, this heating will require a comparatively short time if the vessel is placed in water kept at a little higher temperature than 170° F. When the contents are a heavy, thick syrup, the time required will be longer. And where, as is generally the case, the contents are partly solid (fruits), and even hard and compact (stones of fruits), the operation would require several hours or days before the temperature everywhere inside the vessel could reach 170°. But if kept for any such long time the result would be to cook or overcook the goods, especially those at the sides of the can or bottle. Hence the vessels are in practice submitted to a much higher temperature, but for a much shorter time, which time varies, with the size of the vessel and the nature of its contents, from a few minutes to one or two hours.

The temperatures usually chosen are either that of boiling

water (212° F.) or higher temperatures ranging between 220° and 240°. These last cannot be obtained in an open bath if water alone is used as the heating liquid, since water boils constantly under atmospheric pressure at 212°. In order to get the higher temperatures it is necessary to heat the water under greater pressure than that of the ordinary atmosphere. For this purpose an "autoclave" or "pressure process" bath or kettle is employed, having a lid that can be screwed down to prevent the escape of steam and so produce a higher pressure and temperature. This vessel is provided with safety-valve, thermometer, and pressure-gauge, and it is usually heated by steam. For the more delicate varieties of fruits and berries most canners prefer to use the open bath, at a temperature of 212° or less; but for certain pulps and large fruits (*e.g.* pine-apples) the higher temperatures are used, especially in those factories where meats are packed as well as fruits.

In some cases the cans and bottles of fruit are placed in an exhausting apparatus after being filled, in order to remove any enclosed air before sterilizing (or "processing", as the heating is technically termed). The idea in doing this is that the air prevents the free access of heat to those parts of the fruits in contact with it. There does not, however, appear to be any good scientific reason for this, and in fact some fruit-packers do not use the vacuum process at all.

Properly sterilized and kept air-tight, fruits may be stored an indefinite length of time without fermenting or putrefying. They are preserved either in water alone, or in sugar-syrup, or in spirit and syrup.

Fruits in Water.—The clean fruits, such as cherries, plums, apricots, pears, &c., are simply placed in the cans or bottles, and then the latter are filled up, either with hot water or with water that has been previously boiled to destroy micro-organisms, and kept as far as practicable out of contact with air. The cans or bottles of fruit are then sealed air-tight, and heated in the steam-bath for the required time in order to completely sterilize them. For the smaller sizes, pints or quarts, about a quarter of an hour's heating is sufficient if they have been filled hot.

A little preliminary treatment is required by some fruits: thus, apples are dipped in boiling water for a minute and then

cooled in cold water before being packed as above. Rhubarb is cut into short lengths, and whole pine-apples are pared. Gooseberries, cherries, &c., are put up in the green or unripe state.

The principal bottled fruits sold in England are Apples, Apricots, Blackberries, Cherries, Cranberries, Currants, Damsons, Gooseberries, Green-gages, Plums, Raspberries, and Rhubarb, with a few mixtures such as Cherries and Currants, Raspberries and Currants.

Fruits in Syrup.—These are put up either in thin “light” syrup or in thick “heavy” syrup. They require a little more preliminary treatment than the fruits in water do. For instance, fruits which have a pulpy interior and easily-ruptured skin, such as cherries and green-gages, are liable to absorb some syrup during the sterilizing process, and this causes the skin to break. As a consequence the syrup becomes turbid with the escaped pulp and of unpleasing appearance. In order to prevent this the fruit is pricked with copper needles before bottling. Some fruits (*e.g.* pears) have to be boiled in water until soft in order to “blanch” them—that is, to eliminate certain acids—and are then hardened again by cooling them quickly in cold water.

To avoid discoloration, any fruits which have had to be pared are not left exposed to the air, but are placed at once in a weak solution of sodium sulphite (about 1 part by weight of the latter in 1000 parts of water). This keeps them white, and at the same time acts as an antiseptic. It may be mentioned that fruits are sometimes bleached by exposing them to sulphur fumes.

Fruits in Light Syrup.—The fruits, prepared as above indicated, and pared, cored, sliced, pipped, or not, as the case may be, are placed in tins or bottles; the latter are filled up with light syrup of specific gravity about 18° Beaumé, closed air-tight, and then heated in boiling water. If filled with hot syrup, about fifteen minutes’ heating suffices for sterilization.

Fruits in Heavy Syrup.—These are prepared first as described above, and then further by a process of candying, before being bottled. They are placed for some days in stronger syrup than that used for the foregoing, then taken out and bottled with syrup still stronger (28° to 30° Beaumé).

A few examples in detail are appended:—

Apricots in Syrup.—For these the fruit is preferably chosen a little underripe, since if too well matured it is liable to crush. The apricots are pared (unless too ripe), cut in halves, placed in cold water until ready for canning, then filled into the tins or bottles, covered with hot syrup, sealed up, and sterilized. Apricots are also preserved whole in syrup.

Cherry Compote.—Either white or red cherries are first candied, and then filled into jars. Hot syrup, consisting of two-thirds sugar-syrup and one-third glucose, is poured into the jars, which are then closed and sterilized.

Strawberries do not preserve their form in syrup unless first candied. These and the cherry compote are examples of “**Wiesbaden Fruits**”, which consist essentially of well-candied fruits put up in strong clear syrup of sugar and glucose.

Apples when preserved in syrup are pared, cored, steeped in a cold solution of alum or of sodium sulphite to prevent discoloration, and put up in syrup which is flavoured in some cases with infusion of lemon-peel.

Apricots, Cherries, Damsons, Figs, Gooseberries, Green-gages, Guavas, Macedoine Fruits, Peaches, Pears, Pine-apples, Plums, and Raspberries are the chief fruits put up in syrup for sale in this country.

Fruits in Spirit.—Cherries are a favourite article for preserving in spirit or “brandy”. For this purpose the ripe fruit is used. It is placed for six weeks in strong spirit (alcohol of 60 per cent); the spirit is then drawn off, mixed with one-third of its bulk of cold strong sugar syrup, and with either one-third or two-thirds of its bulk of water; the larger quantity of water being for the cheaper quality of preserve. Into this mixture the fruit is returned. Various flavourings are added to the alcoholic liquor; in the case of cherries, for instance, coriander, cloves, cinnamon, and vanilla are used. Partly-candied fruits are employed for the higher class goods.

Large quantities of fruits preserved in the three media above-mentioned are imported into this country. California is famous for its apricots, peaches, plums, and pears, the “**Lemon Cling**” peaches and “**Bartlett**” pears being favourite products. Apricots are also sent here from southern France and from Spain; and plums from France, Germany, and Holland. Preserved pine-

apples reach us from Singapore and the United States, and considerable quantities of the fruit are also grown in the West Indies, but are largely shipped to America for canning, Baltimore being the chief centre for pine-apple packing in that country.

We come next to the class of **FRUIT-PULPS AND JUICES**. These substances are of some importance as being largely used in the manufacture of jams and fruit-jellies. **Fruit-Pulp** is generally made by boiling the fruit with about one-eighth of its weight of water for five minutes or so. The proportion of water may vary somewhat with the nature of the fruit; but 1 pint to every 10 lbs. is the approximate quantity. After the pulp has been filled into cans or jars it is sterilized; a 2-gallon can requiring $3\frac{1}{2}$ hours' heating in boiling water (212° F.), or $\frac{3}{4}$ hour at 235° F. The pulp can now be stored, and used for jam-making at any convenient time. Apple and apricot pulps are the two chief kinds prepared, but cherry, green-gage, peach, strawberry, and raspberry are also put up. **Apple-Pulp** is made in considerable quantity for use in various jams. In the preparation of apple juice (see below) the residue left after straining off the juice is pressed through sieves of perforated metal in order to separate the cores and pips. The soft part of the fruit which passes through the sieve constitutes the pulp, which is then bottled and "processed". **Apricot-Pulp** is made from ripe, full-flavoured fruit if it is desired to produce an article for high-class jams, or one that will find a ready sale with confectioners. The apricots are cut in halves, freed from the stones, and then boiled for five minutes with water in the proportion of one gallon for each hundred pounds of fruit.

Crushed Fruits may be mentioned here. They are prepared rather largely in the United States for the soda-fountain trade. The fruits are crushed or grated, placed in boiling syrup, boiled for three minutes, bottled, and sterilized.

Fruit-Juices are used either unfermented, for making fruit-jellies, or fermented, for making fruit-syrups. If the unfermented juice is boiled with sugar and water a jelly is produced. On the other hand, if the juice has been fermented, this treatment results in the production of a syrup. Frequently, however, fruit-syrups are made by simply mixing the plain unfermented juice with cold sugar-syrup, and preserving it with salicylic acid, since it cannot

be sterilized by heat without jellifying. **Apple-Juice** is made in some quantity for use in jelly-making. The pared apples are boiled in water, and, when thoroughly disintegrated, strained through canvas. White juice, for light-coloured jellies, is obtained by using one-half part of water to every one part of apples; ordinary pinkish juice, for red jellies, requires twice the quantity of water. The residue after straining is used for making apple-pulp.

Jams are conserves of the pulp of succulent and juicy fruits, prepared by boiling the latter with sugar. They differ from fruit-jellies inasmuch as these are translucent gela-
 tinous preparations of the juice alone; whereas jams Manufacture
of Jams.
 are opaque, pulpy substances, made typically from the whole of the fruit—rind, pulp, and kernel. The fruit may be either entire or partly broken. Jams are made either with fresh fruit or with fruit pulp. Formerly the art was a purely domestic one, and, the method of storing fruit or pulp in water being unknown, it was necessary to make the jam in the fruit season. In modern jam-making the fruit or pulp can be stored for use at any period. The quantity of sugar used varies from about two-thirds to an equal weight of the fruit taken. The boiling should be conducted at a gentle heat, and for as short a time as possible after the addition of the sugar, since this by long and violent boiling with the fruit-acids tends to pass into “invert” sugar and become syrupy. In modern factories large steam-jacketed pans are generally used for the boiling-down process, the evaporation being finished in about ten minutes.

Common Jams.—For the commoner kinds of factory-made jam fruit-pulps are largely used, and glucose frequently replaces a portion of the sugar. Moreover, since in making some of the fruit-pulps (*e.g.* apple-pulp), the fruit-juice is first removed, and with it much of the pectose which makes the softer portion of a jam jelly-like instead of syrupy, the place of this pectose is often supplied by adding to the ingredients of the jam some “Japanese gelatine” or “agar-agar”. This “Japanese gelatine” is a purely vegetable compound, and is not the same as ordinary gelatine obtained from animal sources. A typical example of this kind of jam is the following:—

Boil together 100 lbs. of fruit-pulp, 30 lbs. of sugar, and 70 lbs.

of glucose. Before bottling, mix with the jam 20 ozs. of Japanese gelatine, previously soaked and dissolved in water. The pulp used here may be strawberry, raspberry, currant, cherry, plum, apple, blackberry, damson, gooseberry, &c., giving, of course, the corresponding jam. Colouring is added where necessary—*e.g.* cudbear for red jams.

Raspberry Jam affords a good example of the different grades in which a jam may be prepared:—

Best.—Equal parts of raspberries and sugar.

Second.—14 lbs. raspberries, 20 lbs. sugar, and 6 lbs apple-pulp.

Third.—10 lbs. raspberries, 30 lbs. sugar, 14 lbs. apple-pulp, 12 lbs. green gooseberry-pulp, and 7 lbs. glucose; colour with cochineal. The pulps are first brought to the boil, then the sugar, glucose, &c., are stirred in, and the whole finally boiled till sufficiently done.

High-class Jams from fresh fruit are illustrated by the following typical recipe:—Boil 20 lbs. of the fruit with 1 quart of water; also dissolve 16 lbs. sugar in a small quantity of water and boil it until it will become brittle on cooling. To this now add the fruit, and boil until the jam will drip like jelly from the spoon.

Another process for fine jams consists in partly candying the ripe fruit by heating it with sugar-syrup two or three times, and then storing it in syrup till wanted. Apple-juice is used to form the body of those jams, the juice being clear, to show the whole fruits which the jam contains.

One or two typical recipes for favourite jams are appended:—

Apricot.—20 lbs. apricot-pulp, 15 crushed sugar, and 8 glucose. Some makers use double the quantity of glucose and add a dozen pounds of apple-pulp.

Black Currant.—14 lbs. fresh fruit boiled for ten minutes with 3 quarts of water, then 16 lbs. white sugar added, and the whole boiled for twenty minutes.

Plum.—60 lbs. fruit, 60 sugar, 10 apple-juice, and 7 glucose.

Strawberry.—18 lbs. fruit, and 20 crushed sugar. Boil twenty minutes, dropping in as required 3 or 4 ozs. butter to prevent frothing over.—Very few strawberries come from abroad.

The old method of preventing mould forming on the top of jam after putting it into jars was to put on the surface a disc

of paper soaked in brandy. The modern and much more efficacious way is to soak the paper in solution of borax or salicylic acid.

Marmalade.—The name of this product arises from the Spanish term for the quince, *marmela*. Jam made originally of quinces and honey (now of quinces and sugar) was called *marmelada*; and from this the name, slightly altered, became transferred to orange jam.

Sour or bitter oranges are preferred for marmalade, the best preserve being made from "Seville sour". A common proportion of fruit to sugar is about 25 parts of fruit to 22 parts of crushed sugar. The oranges are cleaned and cut in halves (or smaller portions); the fleshy portion is held against a revolving boss which scoops out the pulp; the latter is squeezed to liberate the juice from the cellular tissue, and then passed through a "searcher" which removes the tough skin and pips. Meanwhile the peel is sliced into thin rings by revolving knives, and softened by steaming. The peel and the juicy pulp are then mixed with the sugar and boiled in steam-jacketed pans to the requisite consistency. On a small scale of preparation the following may be taken as a typical marmalade recipe:—Scald and peel the oranges, and slice the peel into shavings. Cut up the fleshy portion, and remove the pips and any residual white skin. Mix the pulp thus obtained with sugar and apple-juice in the proportion of 6 lbs. of sugar and 1 quart of juice to every 4 lbs. of pulp. Add the sliced peel and boil the mixture slowly for an hour; then boil faster until the marmalade is sufficiently concentrated. "**Home-made Marmalade**" is produced largely in some jam-factories, as well as in the domestic fruit-kettle. It differs from the ordinary or Scotch marmalade in that only the orange juice, and not the pulp, is boiled with the sugar and peel.

Strictly, a jam should consist only of the fruit after which it is named, together with sugar; and any additional substance might be regarded as an adulteration. It is a moot point whether apple-pulp ought to be allowed, or apple-juice, except in those cases where the fruit does not set well without such additions. Gelatine is quite likely to be objected to, as is also any preservative such as borax or salicylic acid. An excessive quantity of water would probably be deemed

Marmalade:
how made.

Adulterations
of Jam.

an adulteration, but there is no actual standard fixed whereby it can be determined what constitutes an excessive amount. A maximum of 50 per cent has been proposed as the standard. As regards sugar, in a case taken to the high court an addition of 13 per cent of glucose to marmalade was held to be legal. It used to be a canon of jam-making that only cane sugar could be used for jam if it was required to be of good flavour and keep well; but as a matter of fact beet sugar is now very largely used, as well as glucose. Figs, vegetable marrow, beet-pulp, boiled sago, and such like articles have been met with in low-quality jams. These are, of course, palpable frauds; but the use of damaged fruit of the same kind as that which gives its name to the jam is rather a matter of inferior quality than of adulteration.

In examining jam for any suspected ingredient, such as a different fruit or a vegetable admixture, about a tea-spoonful of the jam is stirred up in a beaker or tumbler with warm water. This dissolves the sugar, jelly, &c., leaving the pieces of skin, seeds, and fibre; these latter can be fished out and any suspected portions further examined under a hand-lens or microscope. Apple-pulp is detected by means of the starch which it naturally contains. Boil one ounce of the jam with about five ounces of water for a minute or two; let it get cold, and pour off some of the liquid portion into a test-tube or wine-glass. To this add a drop or two of tincture of iodine. If any starch was present in the jam the mixture will turn blue. If no blue colour is obtained there is no apple-pulp in the jam, nor any other starchy substance. If a blue colour does appear it is in all probability due to apple-pulp, because other starch-yielding additions are comparatively rare. To determine conclusively whether the starch was furnished by apple-pulp or by some other added ingredient it is necessary to examine the residue of the boiled mixture under the microscope; and this, as well as the detection of gelatine, can only be properly done by an analyst.

JELLIES are our fourth class of preserves. The various kinds of jellies such as Aspic, Calf's-Foot, Currant, Guava, and Table Jellies, all belong to one or other of two groups. In one of these groups the jellifying ingredient is of vegetable origin;

the members of this group are the numerous **Fruit Jellies**. In the other the typical jelly-producing substance is gelatine, isinglass, or some similar article of animal origin, calf's-foot jelly being a good example of this class. Certain gelatine substitutes obtained from plants are, however, used for the cheaper articles in both classes.

*Jellies and their
Manufacture.*

Fruit Jellies.—Under this name are included conserves of fruit having for their basis the various fruit-juices and sugar, but into which the fruit-pulp does not enter. Fruit jellies are transparent or translucent substances, more or less coloured according to the fruits employed, and of more or less firmness according as they have been heated for a longer or a shorter time. They are liquid or semi-liquid whilst warm, and become stiff on cooling. They owe their property of gelatinizing or jellifying to the presence of a gummy principle in their composition called "pectin". Except in its gelatinizing effect pectin is in no way related to gelatine. Pectin itself is only found in very ripe fruits; but in growing and partially-ripened fruits an allied body, "pectose", is plentiful, and this is easily converted into pectin when the juice of these acid, unripe fruits is boiled. In the case of some hard fruits this conversion is partly effected, no doubt, during the boiling of the fruit which is necessary in order to extract the juice completely. (See FRUIT-JUICES.) In any case the juice, whether obtained by cold pressure or by heating, is next boiled down with sugar to form the fruit jelly. The quantity of sugar required will vary from about two-thirds to an equal weight of the juice: a pound of sugar to a pint of juice is a common proportion. Such "pure-sugar" jellies, however, are often too sweet for the average taste. The consumer will frequently prefer a jelly made with a mixture of sugar and glucose in equal proportions, glucose being less sweet than sugar. It is essential that fruit jellies should be bright and clear. To ensure this the juices in the first place should be as free as possible from pulpy matter and cloudiness, so that the less the fruits are squeezed through the strainer the more transparent will be the jelly. Next, the boiling with sugar requires to be carefully done if a nice bright jelly is to be the result. The following is said to be one of the best modes of procedure:—

Put the proper quantity of sugar in the pan, together with

enough water to dissolve it, and no more. Boil the solution, skimming it frequently, until the syrup becomes so concentrated that a little of it cooled in water will form a brittle sugar. Now add the fruit-juice, and continue boiling until the mixture will drip in jelly when taken up with the stirring-spoon.

Black, white, and red currants; gooseberries, blackberries, strawberries, and raspberries; apples, pears, quinces, oranges, and pine-apples are the chief fruits whose juices are used for jellymaking. But some of these, especially the berries, give a rather soft jelly when the pure juice is employed, so that it is a common practice to mix apple-juice with the juices in question, in order to obtain a firmer product. About one-third to one-half of the total juice in such cases consists of apple-juice, orange and pine-apple requiring the latter quantity. Indeed some jellies (*e.g.* orange and lemon) may be made with no other juice than that of the apple. In such instances the jelly is flavoured with about 1 per cent of orange or lemon spirit, and acidity imparted by the use of one-third to one-half per cent of citric acid and tartaric acid respectively. The white apple-juice is used for the light-coloured or yellow jellies such as quince, orange, and pine-apple; for the red jellies, common or pink apple-juice is employed.

Guava Jelly is prepared in essentially the same way as the fruit jellies described above. The guava is the fruit of a genus of trees common in the West Indies, South America, and Ceylon, that most esteemed for jelly-making being the pear-shaped fruit of the white guava-tree, *Psidium pyrifera*. It is gathered whilst still barely ripe, sliced up, and the pieces heated with a little water for an hour or so to extract the juice. The latter, after straining, is boiled with an equal quantity of sugar to make the jelly, which may be flavoured with a little lime- or lemon-juice.

Compound Jellies are manufactured as a somewhat cheaper article than the pure fruit-jellies above mentioned. They contain a certain proportion of so-called "Japanese gelatine", which is not gelatine at all, but a vegetable substance; moreover, the sugar is largely or entirely replaced by glucose. The method of preparation differs a little from that used for the all-fruit jellies, because the "gelatine" cannot be boiled with the acid fruit-

juices without undergoing a change which prevents its subsequent "setting" or jellifying.

Sugar and glucose, in the proportion of 26 lbs. of the former to 54 lbs. of the latter, are dissolved by heating with a little water, and in another vessel $17\frac{1}{2}$ ozs. of previously-soaked "Japanese gelatine" are dissolved in water and mixed with 18 lbs. glucose. Both vessels are heated and skimmed to remove floating impurities, and the contents of the second vessel are added to the first. Then in the empty pan are boiled 18 quarts of the requisite fruit-juice—apple, currant, quince, strawberry, &c.,—the contents of the two pans being then mixed while hot, but not being allowed to boil after mixing. $9\frac{1}{2}$ ozs. tartaric acid dissolved in $1\frac{1}{2}$ pints of water are added to the mixture, which is then coloured as desired with cochineal extract for strawberry jelly and cudbear extract for the other red jellies. By using only glucose instead of sugar a still cheaper jelly is made, 1 oz. of Japanese gelatine being taken for every 3 quarts of jelly required.

Table Jellies.—The chief bottled table jellies are *Aspic*, *Calf's Foot*, *Lemon*, *Madeira*, *Noyeau*, *Orange*, *Pine-apple*, *Port Wine*, *Punch*, and *Vanilla*. The better qualities have gelatine as their basis, but in others the so-called "Japanese gelatine" or similar vegetable substances are employed. Those containing true gelatine are made bright and clear by clarification with white of egg. Various flavouring, colouring, and sweetening ingredients are added to form the different kinds of jellies. With the exception of aspic, all the jellies mentioned above are put up with wine, and some are also prepared "plain", the principal plain kinds being *Aspic*, *Calf's Foot*, *Lemon*, and *Orange*.

Aspic Jelly is an amber-coloured savoury jelly made with gelatine and meat-broth, together with flavouring materials, &c. It is used as a decorative moulding for ornamenting cold viands, the latter being visible through the jelly on account of its transparency.

Calf's Foot Jelly is now generally made from gelatine, although, as the name indicates, it was originally a preparation of neat's foot or of cow-heel; sherry, Madeira, or Cognac being used as the flavouring ingredient.

The various other jellies are prepared substantially as follows:—Gelatine is cut small and soaked in water, to which in some

cases broth and other ingredients are added, matters being arranged so that about a quart of liquid is present for every 4 ounces of gelatine. This is steamed or otherwise gently heated to dissolve the gelatine, and if necessary clarified by the addition of white-of-egg, then strained from the coagulated albumen, and mixed with any of the requisite colouring, sweetening, and flavouring ingredients that have not already been included.

Table Jellies in Tablets and Powders are now sold rather extensively. They have the advantage of being much more portable than the bottled jellies. With the exception of aspic, all those mentioned above are put up in tablet form, as well as some others, of which the principal are Champagne, Cherry, Cognac, Currant, Raspberry, and Strawberry.

17. PICKLES AND VINEGAR

In summarizing the various "Methods of Preserving", it has already been mentioned that the use of semi-preservatives, such as various acids, constitutes one of the means employed. The "curing" of vegetables by means of vinegar or acetic acid is the most notable example of this method of food-preservation, and is what is familiarly known as "pickling". The acid of vinegar is a preservative, because most of the ordinary putrefactive bacteria contained in the air—and therefore sooner or later in things which have been exposed to the air—are unable to develop in liquids which are strongly acid. But it is only a semi-preservative, because it does not destroy all these organisms. Certain moulds and ferments flourish quite well in weak vinegar. It is well known, for instance, that pickles will sometimes become mouldy, especially if the vinegar used is very much diluted.

In the ordinary process of pickling, the vegetables are first partially "cured" by being placed in brine for a length of time varying from a few days to several weeks. They are then removed, well washed with cold water, drained, cut up if necessary into convenient pieces, and filled into the jars or bottles for storing. There are various differences of detail in the subsequent procedure, depending partly on individual taste and partly on the kind of pickle dealt with. For ordinary mixed

**The Process
of Pickling.**

pickle one direction is to fill up the jar containing the vegetables with clean cold water, then to empty this water out, turn the jar upside down, and allow it to drain for two or three hours. After this the jar is filled nearly to the top with vinegar, a little pickling-spice is added, and the jar corked, sealed, and set aside for use.

An improved method, however, has been introduced for factory-made pickles, whereby weeks or even months of time are saved. The reason for the long treatment with brine and vinegar in the ordinary household method is to allow of the salt and the vinegar penetrating right into the interior portions of the vegetables, and this is a slow process. In the improved operations the object is accomplished by first exhausting the vegetables under an air-pump, whereby the air is sucked out of the internal cells and a comparatively free passage opened. Spiced pickling-vinegar is then forced into the vegetables at a pressure of about 45 lbs. to the square inch, so that the acid finds its way to the interior almost immediately instead of by gradual percolation, as in the older process.

London is the principal centre for pickle-making in this country, and large quantities of vegetables in brine come into the Thames for pickling purposes from Holland, France, and Germany. The vinegar used in pickle-factories is often not malt vinegar, but an aqueous solution of acetic acid coloured with caramel, and containing from 3 to 4 per cent of absolute acetic acid. The filling of the bottles is usually done by girls. Machinery has been tried, and may perhaps still be used in certain kinds of work; but there is some art and considerable practice required to fill such goods as mixed pickles so as to display them to the greatest advantage, consequently these pickles are always filled by hand. The filler uses a stick in arranging the vegetables, and places a piece of cauliflower, for instance, in such a position as to display the flower and conceal the stalky part as much as possible. There is, of course, no essential difference between factory-made pickles and the home-made product; but the former are generally put up more tastefully, especially in the case of certain American and Continental brands. The large maker, too, has the advantage of experience in selecting and proportioning his vegetables.

Cabbage, Cauliflower, French Beans, Gherkins, Mixed Pickles, Onions, Pickalilli, and Walnuts are the chief kinds of pickles sold

in this country. Before treating the individual products, however, it will perhaps be well to describe shortly the principal materials—the vinegar and the vegetables—with which the pickles are compounded. Conveniently, also, the other kinds of vinegar used as condiments may be mentioned at the same time as the pickling-vinegar.

Vinegar.—The acid of vinegar is acetic acid, and in all the manufacturing processes for the production of vinegar this acid is formed from alcohol by the vinegar-fungus, a microscopic ferment known in the mass as “mother of vinegar” (*Mycoderma aceti*). The souring of wines, beers, and other alcoholic liquids is also due to this organism, the germs of which are present in the air, ready to fall upon and develop in any suitable medium which may be exposed to it for a short period. The production of the acid is quickest when the liquid is rich in vegetable matter and poor in alcohol, and when there is a large surface exposed to the air. Still, the quantity of alcohol should not be too small; when it is less than 3 per cent the “acetous fermentation”, as it is called, proceeds only slowly. In recent years the question has often arisen, “What constitutes vinegar?” Acetic acid can be obtained from several sources, as, for instance, the distillation of wood or the chemical oxidation of alcohol. To exclude these, one definition of vinegar stipulates that it must be the product of the alcoholic and acetous fermentations of a vegetable juice or infusion. This is a general definition, and it includes several varieties of vinegar, *e.g.* malt vinegar, wine vinegar, cider vinegar, and ale vinegar. Then to narrow its scope in the case of the first-named, it has been proposed to define malt vinegar as being a vinegar prepared from malt and unmalted barley, the mixture containing not less than one-third malt. At present, however, this is only a proposal; and it is not easy to see how, if it were adopted, the proportion of malt used in the mixture could be ascertained from the finished vinegar.

Malt Vinegar.—Two chief processes are used for the manufacture of this article. Crushed malt is extracted three times with hot water, using not more than 100 gallons of water for six bushels of malt. The cooled infusion is then fermented with yeast for a couple of days, whereby alcohol is produced. It is then filtered from the solid matter, and acetified, *i.e.* fermented with the acetous

ferment, in large casks provided with holes for the circulation of air. This acetifying is done either in a room kept at a temperature of about 75° F., or in a "vinegar field" in the open air during the warm spring and summer months, about twelve weeks being required for the operation. Before storing, the vinegar requires to be filtered from the deposited extractive matter, which is done by passing it several times through a cask containing a layer of shavings, or better, "rapes", these being pressed cakes of the stalks and skins of grapes and raisins obtained in the manufacture of British wines. In this way all but the last traces of alcohol are oxidized, and the vinegar cleared and brightened. Vinegar intended for pickling purposes is made by the above process.

For household vinegar the method is somewhat modified, acetification being carried out in upright casks fitted with false perforated bottoms covered with a layer of "rapes". Here the liquid is kept for twenty-four hours, when it passes to another cask for a few days, and so on through a series of casks. It is finally clarified with isinglass, a little argol being frequently added to give a flavour of wine vinegar.

The second process is known as the "quick vinegar process". It differs from the foregoing essentially in the acetification being expedited by exposing a very large surface of the liquid to the action of air. This is effected by causing the malt infusion to trickle down threads of yarn and through a large quantity of beechwood shavings or small pieces of charcoal previously "soured" with fermented vinegar. The time required by this method is only a fraction of that needed in the first process, but more alcohol, and hence more acetic acid, is lost by evaporation. Brandy, beer, whisky, molasses, and honey are used for vinegar-making by this process, as well as the malt infusion.

Malt vinegar has a pleasant refreshing odour, which is due to the presence, in addition to the acetic acid, of acetic ether and some other ethers. A small quantity of acetic ether is sometimes purposely added to increase this aroma. In addition to these, small quantities of alcohol, gum, sugar, and nitrogenous bodies are present, with appreciable amounts of sulphates, chlorides, and phosphates. The last, more especially, serve to distinguish genuine malt vinegar from artificial vinegar, which is made by mixing acetic acid with

water, colouring the mixture with caramel, and flavouring it with acetic ether.

Four strengths of commercial malt vinegar are recognized, and are known as Nos. 18, 20, 22, and 24. These numbers denote the grains of pure dry sodium carbonate which are required to neutralize the acidity of one fluid ounce of the four vinegars respectively. No. 24 is called "proof" vinegar; it contains 6 per cent of absolute acetic acid. The actual strengths, however, vary somewhat with different makers. Good ordinary vinegar usually contains from 4 to $5\frac{1}{2}$ per cent of acetic acid. The Society of Public Analysts recommends that 3 per cent should be the minimum allowable. Appended is an analysis of a good commercial malt vinegar:—

Acetic acid	...	...	...	5.32 per cent.
Solid matter	...	...	...	3.97 "
Ash	...	...	...	0.38 "
Sulphuric acid in sulphates			...	0.05 "
Phosphoric acid in phosphates			...	0.10 "
Common salt	...	...	...	0.08 "

Specific gravity, 1.0226

Wine Vinegar, "White" Vinegar, or French Vinegar is generally made from sour wine, substantially in the same manner as in the acetification already described. Full-bodied wines one year old are preferred for the manufacture, which is carried on in the Orleans and other wine-districts in France, along the Rhine in Germany, and also in Holland. Good wine vinegar contains about 6 per cent of acetic acid. The genuine article is said to always contain cream of tartar, derived from the fermenting wine; but much of the "white" wine vinegar met with in commerce is not genuine. The colour of wine vinegar varies from pale-yellow to red.

Cider Vinegar is of a yellowish colour, contains $3\frac{1}{2}$ to 6 per cent of acetic acid, and when evaporated leaves a residue which smells and tastes of baked apples. **Perry Vinegar** is used locally in the Hereford and Monmouth district. **Glucose or Sugar Vinegar** is made by fermenting and acetifying glucose-solution, and is said to be used for adulterating wine vinegar.

The vegetables used in pickling are the following:—

Cabbages (Red).—In addition to the home-grown supply large quantities of red cabbage are imported from the Continent, chiefly from Holland. They arrive in the winter months, packed in bags. There are several varieties, of different colours varying from light-red to deep-red, purple, and blue; and of different-shaped heads, ranging from compact and close to open and spreading. **Cauliflowers** are largely grown in England, more especially in the southern districts, in the neighbourhood of London, in Devonshire, Cornwall, and the Channel Islands. In addition to these some thousands of casks of cauliflowers preserved in brine are annually imported from Amsterdam, Rotterdam, and other Dutch ports. The cauliflower is a variety of ordinary cabbage, having an exaggerated or deformed inflorescence. This inflorescence or “flower” is the portion used for pickling and culinary purposes. It is a nutritious substance, comparatively rich in albuminoids and phosphates. **Cucumbers**, besides being raised in quantity in Bedfordshire and other English districts, are also largely imported from the Continent, chiefly from the Dutch ports. Like the cauliflowers, they are sent over in brine, hundreds of casks being landed in the Thames every year. **French Beans** (*Phaseolus vulgaris*) are leguminous plants, which may be looked upon as a small variety of the common Scarlet Runner. They are gathered when quite young and tender, and the whole pods are preserved in brine or packed in salt. **Gherkins**, like cucumbers, are extensively imported in brine from Holland and France. They may be either a small-fruited variety of the ordinary cucumber, or small young cucumbers of the larger varieties. Traces of copper are said to occur naturally in gherkins; but in any case they are sometimes purposely greened by heating them in copper vessels, whereby minute quantities of the metal are dissolved by the vegetable acids, and act as a mordant in developing the green colouring-matter of the gherkin. **Onions** are grown for pickling purposes to a considerable extent in England, the most noted counties for the culture being Warwickshire and Bedfordshire. The “Silverskin” onion, grown especially in the latter country, is esteemed as the best for pickling. Holland also sends us large quantities of small onions which can be used for pickles; and a certain number of Egyptian onions are employed for the same purpose in the spring months, before the Dutch supplies come to hand. **Walnuts** preserved in brine for

Pickling
Vegetables.

pickling arrive in quantity from several Continental countries, chiefly from France, Italy, Belgium, and Germany. They are, of course, also grown to some extent in this country. The green, immature nuts are selected for pickling on account of their tenderness; if allowed to grow too old the shells become woody and hard, and are not properly softened again during the pickling process. Raw vegetables to the value of over four millions sterling were imported into the United Kingdom during the year 1900, a good proportion being evidently for use in pickle-making.

Pickled Olives are mentioned in the chapter ON GREEN FRUITS, &c., p. 266.

Individual Pickles.—A few examples of typical pickles are appended, to illustrate the general character, composition, and methods of preparation of the principal kinds. It may be mentioned that either glass vessels or jars glazed with leadless glaze should be used for pickles, on account of the facility with which the acid of the vinegar dissolves out lead from vessels coated with a soft lead glaze.

Pickled Cabbage.—The firmest and most compact heads of red cabbage make the best pickle, and they are preferred slightly frost-bitten. After the outer leaves have been removed the cabbage is cut into sections and then sliced. The sliced cabbage is now salted and left for a couple of days to drain, with an occasional turning over. It is then filled into jars until the latter are about three-fourths full, and cold vinegar which has been previously boiled with pickling-spice is poured into the jars till the cabbage is covered. After stirring up the contents the jar is ready to be corked and finished off. Red cabbage is prone to deteriorate on keeping, turning soft and losing colour on exposure to light. Sliced beet-root is sometimes added to it to improve the colour. Cauliflowers, as also Gherkins and Onions, are pickled in essentially the same way as Mixed Pickles (which see). Frequently pickled cauliflower is coloured yellow with turmeric. This gives it a better appearance, but the use of too much turmeric is apt to make the pickle taste rather musty, unless masked by pungent spices. Waste pieces of cauliflower stalks and trimmings are used for low-class pickles, in which the vinegar is often poor in acid; so that when kept too long, and especially if badly corked, a growth of mould is liable to form on the top of the pickle. With care this

mould may be removed, and some fresh strong vinegar added, provided the growth has not gone too far. The pickle is then as good as it was before the mould formed.

Mixed Pickle.—The constituents of this pickle as made in England are usually either cauliflower, French beans, gherkins, and onions, together with spices and vinegar; or else the same ingredients with the French beans omitted. An analysis of this latter kind of pickle, put up by a well-known firm and fairly typical of the ordinary commercial article, will show the approximate proportions of the various constituents:—

Analysis of Mixed Pickle.

Vinegar, drained from the pickle	...	...	32.1	per cent by weight.
Drained solids	...	...	67.9	" "
			<hr/>	
			100.0	" "
Composition of drained solids:				
Cauliflower	...	...	17.9	per cent of the pickle.
Gherkins	...	...	25.0	" "
Onions	...	...	23.8	" "
Spices	...	...	1.2	" "
			<hr/>	
Total drained solids	...	...	67.9	" "
Specific gravity of the drained and filtered vinegar ... 1.0303				
Percentage of acetic acid in drained and filtered vinegar ... 3.33				

This percentage of acetic acid is rather lower than was actually in the original vinegar, because the water already contained in the moist vegetables before the vinegar was added to them has now become mixed with the vinegar, and to that extent has diluted and weakened it. Probably the original vinegar contained between $3\frac{1}{2}$ and 4 per cent of acetic acid. A good mixed pickle of the foregoing class will usually contain from 17 to 23 per cent of cauliflower. This, as well as the other vegetables, should be neither soft nor tough, but crisp and readily breakable between the teeth. For the best mixed pickle the finer qualities of cauliflower are used, not fibrous, and without much stalk; the gherkins, as also the beans, should be small, young, and tender, and the onions should be small, of uniform size, well-flavoured, and not flabby or tough. Within limits, the stronger the vinegar the better the pickle.

In the cheaper kinds of mixed pickle older and more stalky cauliflower is employed; the gherkins may be larger, speckled, and ill-shaped, or they may be replaced by slices of cucumber; the beans may be older; the onions large, coarse, and perhaps flabby; and the vinegar weaker. It is chiefly in these points that the lower qualities of pickles differ from the best kinds; but there are also some minor considerations, such as the relative proportions of the vegetables, the choice of spices, and the tasteful display and finish of the samples.

The process of making mixed pickles has already been outlined at the beginning of this article.

Piccalilli corresponds to mixed pickles in respect to its vegetables; but the liquid, instead of being ordinary pickling-vinegar, is a special preparation containing mustard and turmeric. One method of preparing this yellow liquor is as follows:—Into a vessel which can be heated pour 6 gallons of vinegar, and to this add 7 lbs. of mustard, 12 ounces ground turmeric, and 2 ounces of finely-ground cayenne; 2 ounces of gum tragacanth dissolved in water may also be added, and is an improvement. Mix the whole of these ingredients thoroughly, and heat the liquid to its boiling-point with constant stirring. Pass it then through a fine sieve, and when cold pour it into the pickle-bottles, which should be filled about one-third full. Meanwhile the vegetables have been prepared in the same way as for mixed pickles, and are now filled into the bottles containing the liquor, which are then corked and finished off in the usual way.

The piccalilli liquor, being yellow and opaque, serves sometimes to cover the use of inferior vegetables, the defects of which cannot be well seen without draining off the liquid and removing the solids to clear vinegar or water.

Chow-chow Pickles are a sort of modified Piccalilli, the difference consisting in the different spices used for flavouring. Curry-powder added to ordinary Piccalilli converts it into a good Chow-chow pickle, or at least into a good imitation of the genuine East Indian article.

Pickled Walnuts.—In preparing these the young nuts, taken from the brine in which they arrive at the factory, are first pricked in some eight or ten places, and then exposed to the sun or to bright daylight in the open air until they turn black. After this

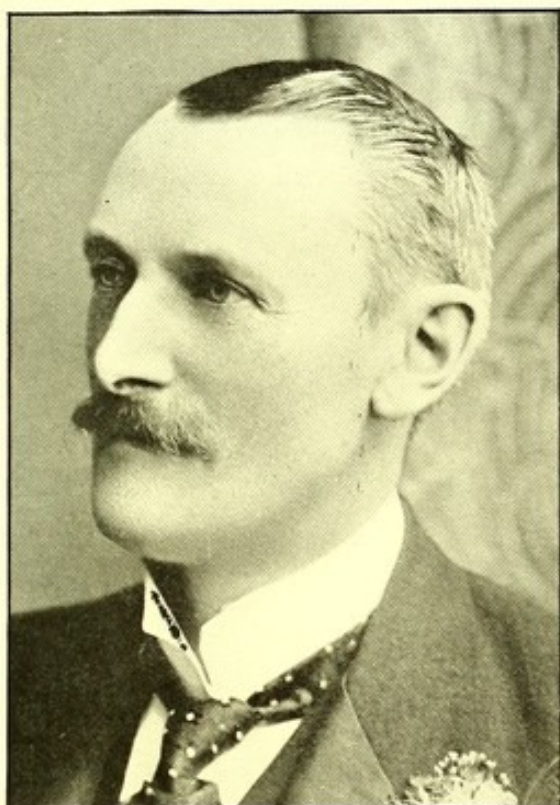
Sir WALTER PALMER, Bart., M.P. for Salisbury, is a director of the world-famous firm of Huntley & Palmers, Limited, and a son of its founder, the late Mr. George Palmer.

Mr. ROWLAND ALSTON, president, in 1904, of the Tea Buyers' Association, is one of the directors of Peek Brothers & Winch, Limited, whose house is a prominent feature of Eastcheap.

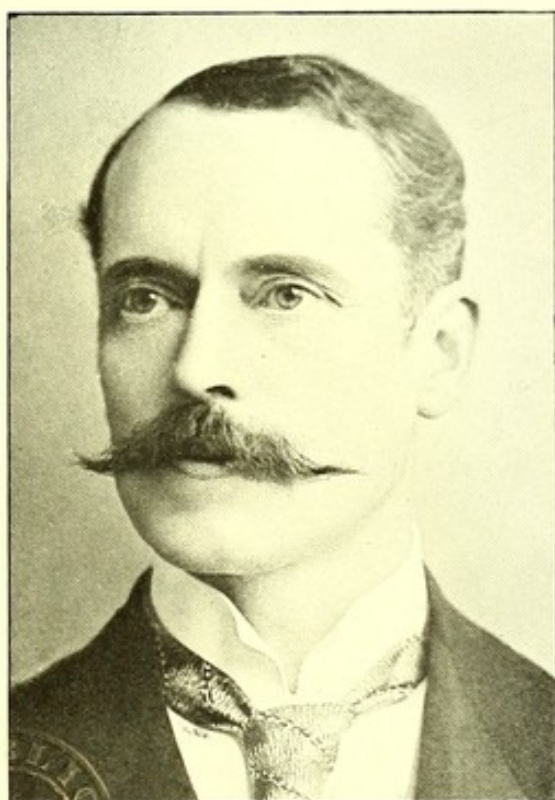
Sir THOMAS PINK is sole partner of the firm of E. & T. Pink, wholesale grocers, manufacturers of Pink's jams, marmalade, pickles, and confectionery, and occupying extensive premises in Staple Street, Borough, London.

Mr. DANIEL MACEWEN, J.P. for the County of Perth, is the senior acting partner of the firm of D. & J. MacEwen & Co., Stirling, whose centenary was celebrated in March, 1904, by a banquet given to the firm by the wholesale trade. He has taken a prominent part in Government enquiries concerning trade matters, and is well known in Scottish public life, having been for many years chief magistrate, &c., of Callander.

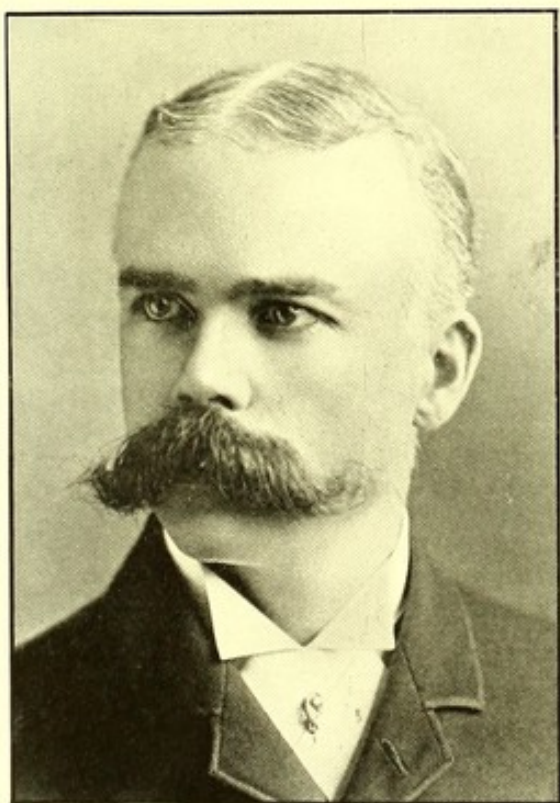
LEADING MEMBERS OF THE TRADE



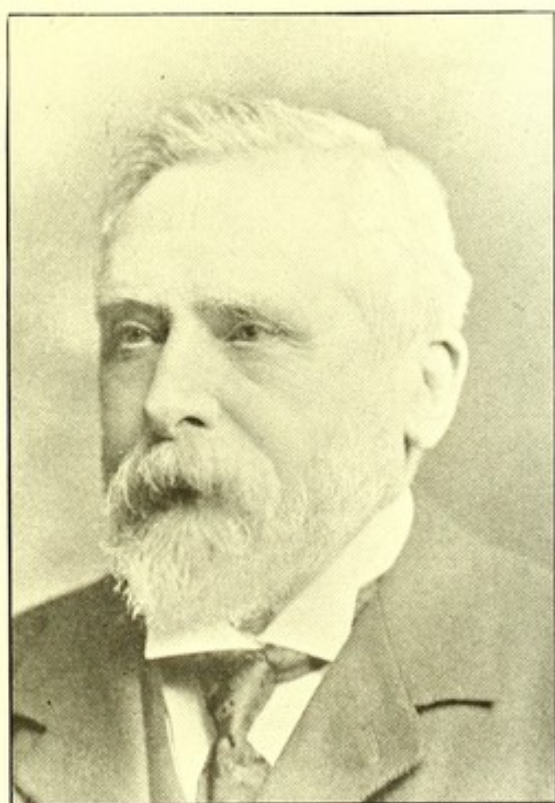
SIR WALTER PALMER, BART.



ROWLAND ALSTON



SIR THOMAS PINK



DANIEL MACEWEN, J.P.



they are soaked in vinegar for a short time, and then filled into bottles, care being taken not to break the fruit. The bottles are then filled up with spiced vinegar, and corked and finished as usual, a piece of ginger being often placed on the top of the walnuts to make the pickle more pungent.

Pickles constitute a useful adjunct to food, and are often of value in rendering it more palatable, and in imparting a relish to otherwise unattractive viands. As a rule, however, they are not themselves very digestible articles, and are best used in moderation. The demand for pickles is generally briskest during the spring and early summer, before fresh tomatoes, cucumbers, &c., have become plentiful. Consumers sometimes complain that English pickles, though they may be intrinsically good, are often put up in a less tasteful and attractive manner than their foreign rivals. In a few instances this is no doubt true, and where it is so the makers would be well advised to improve their packing methods, especially in view of threatened American competition in the English markets.

The Pickle Season.

18. BREAD, BISCUITS, AND CAKES

Among the thousand-and-one articles with which the grocer has to deal, none is more important to the community than bread. And as in everyday life the luxuries have their place as well as the necessities, so the cake and biscuit claim attention as well as the loaf. Practically all grocers sell biscuits. Many also handle cake and bread, and not a few now make their own bread. Although bread is not strictly included in "groceries" we may conveniently speak of it here.

BREAD.—Though there are many kinds of loaves, they can, to begin with, be classed into two main divisions—bread made with yeast, and bread made without it. As regards materials, ordinary leavened bread should consist only of flour, yeast, and water, with perhaps a little salt. In the fancy breads milk may be wholly or partially substituted for the water. Bread-making, in its essential features, is the same everywhere. It consists in the gradual but thorough admixture of flour, water, and salt in the proper proportions to produce dough, which is

Bread and Bread-making.

then, either with or without fermentation, heated until sufficiently baked. But in the details of manipulation there is great variety, and the products are very diverse.

When loaves are required it is necessary to lighten the mass of dough by the introduction of air or other gas, so that it may assume a spongy character, and be readily broken up by the teeth when baked. This in ordinary bread is effected by the use of yeast or leaven. A few words may profitably be devoted to these two substances and their mode of action.

Yeast is in reality a small plant, the granules composing it being round or oval cells about one three-thousandth of an inch in diameter, and of course only visible individually under a good microscope. This plant lives and grows at the expense of any sugary or starchy material in which it may be placed under suitable conditions; the process of growth is "fermentation", and the operation results among other things in the production of carbonic-acid gas. This gas, and its liberation, form the bubbles and give rise to the bursting seen in "working" dough. The kind still used by many bakers is partly prepared by the baker himself. A mash of potatoes is made (technically called "fruit") and fermented with German yeast. About 6 to 8 lbs. of potatoes for every sack of flour (280 lbs.) are boiled and mashed into a paste, cold water being added until the temperature is about 85° F. A quantity of flour (2 to 12 lbs.) is added, together with about a quart of yeast. This mixture, forming a thin paste, is left to ferment vigorously for some five hours, and then about half the flour for the baking is added in bulk. The "up-to-date" baker uses no potatoes, but liquid malt extract and yeast. Ordinary brewers' yeast or "barm" is used in what is known as the Birmingham method of baking. "German yeast" is yeast obtained from fermented liquids by filtering and pressing the yeast into a kind of stiff paste. In this dried form it is very portable, and is imported to a considerable extent into this country, usually in 1/2-cwt. bags.

Leaven is fermenting dough, generally some left over from a previous baking. In England it is rarely used, "barm" having superseded it. But it is still employed on the Continent in districts remote from breweries, and even in Paris some of the finest wheaten bread is made with leaven.

As regards the flour, some of the favourite brands used for bread-making are Hungarian, Spring American Patent (hard), American Winter Wheat-flour (soft), Town-milled 1sts and 2nds, and mixtures of these, with Patents, Whites, &c. The "feel" of the flour between the fingers is often taken as a guide to its quality. If it feels loose and "lively" when rubbed, it is preferred to one which feels clammy and "ball-ey". Another relative test for flours is as follows:—Mix the flours with exactly half their weight of water. The best flour will make the stiffest dough. Or make a small quantity into dough, and let it stand for four hours. Then if a gentle stream of water is allowed to fall upon it while held in the fingers, the starch will be washed out, and the gluten left in the hand. This, if good, will be found tough and elastic as an india-rubber ball, while an inferior quality will tear easily. The gluten should then be dried gently for four or five days—if possible in a water oven; then by weighing the gluten its percentage in the flour is found.

The operation of mixing the prepared ferment (technically called "fruit") with flour is termed "setting the sponge". The flour used at this stage, when "full sponge" is made, should be about one-half the entire quantity intended to be used in the batch, and the ingredients require to be thoroughly incorporated, enough water being used to make the whole into a rather stiff paste. After the sponge has risen and has begun to collapse (which is generally in about four or five hours), the remainder of the flour is added and the whole kneaded. The finished dough is then covered and allowed to stand for some time—from half an hour to two hours, according to the temperature—during which time there is a further amount of fermentation. The mass is then "proofed" and "scaled off", 4 lbs. 4 ozs. being weighed out to produce a 4-lb. loaf, after which it is moulded into loaves. In some parts of the country (Scotland, Birmingham) the yeast or barm is mixed directly with the flour and water. Good sound flour yields from 90 to 94 4-lb. loaves per sack of 280 lbs. Some strong flours give an even greater quantity of bread. Messrs. Lawes & Gilbert found, as an average of a number of trials, that every 100 lbs. of flour yielded 135.2 lbs. of bread, but this is probably rather higher than ordinary.

Leavened Bread.—In making ordinary leavened or fermented

bread the yeast or leaven, after being incorporated with the flour by kneading, sets up a fermentation during which the starch of the flour is partly converted into sugar, and then, further, into alcohol and carbonic-acid gas. The gas forms innumerable cavities throughout the dough; and when the latter is baked, both the alcohol¹ and the carbonic gas are expanded and subsequently expelled, leaving the bread in a porous condition favourable to mastication and digestion. **Unleavened** bread (passover-cakes, oat-cakes, and bannocks), being made with meal and water only, is more sodden and less digestible.

Bakers' bread is made by various processes, classified as (*a*) Ferment and Dough, (*b*) Sponge and Dough, (*c*) Off-hand Dough. The following are recipes for these three methods, as given by Mr. W. J. Wilding in a paper written for the Bakers' National Association:—

Process (a).—Set ferment for one sack flour, 280 lbs., with 2 gallons water, 1 lb. distillers' yeast, 2 lbs. flour, 2 ozs. sugar. When stirred, the temperature should be about 76° F. Let stand one hour, or till it has settled down in tub. Make dough with 12 gallons water, or sufficient water to make a nice dough, 2¼ lbs. salt, ½ lb. "diastase", and sack of flour; temperature of dough to be 78° to 80° F. When made, should stand three hours or so, or till ready to throw out; or it may be "cut back", but this class of dough need not be cut back if properly made.

Process (b).—Set sponge for one sack of flour, with 7 gallons water, ½ lb. yeast, ¼ lb. salt in summer; stir with about 80 to 90 lbs. flour; temperature when stirred 76° F. in summer, little warmer in winter. Ready in about eight hours. Make dough with 7 gallons more water, ½ lb. diastase or malt extract, and 3¾ lbs. salt. (This quantity of salt is a little higher than is usual in England, but prevents insipidity of flavour.) The dough should be "cut back" and will be ready to throw out in one and a half or two hours. Temperature of dough when made, 76° to 80° summer.

Process (c).—For one sack use about 14 gallons water, 2 lbs. yeast (distillers'), 2¼ lbs. salt (or 2½ lbs. in summer), and ¾ lb.

¹ Over forty years ago Odling calculated that the alcohol evolved from baking in London alone was as much as 300,000 gallons of spirits per annum.

malt extract. Make into dough, which should be about 78° F. Cut back every two hours until it has been made eight hours, when it should be ready to throw out. Mould and let it "prove" before going into oven. The oven must not be too hot at first. To prevent too quick crusting bakers often moisten the tops of their loaves before putting them into the oven, or have devices for passing steam over them during the baking. The steam also changes some of the starch into a sort of gum on the top of the loaf, and gives it the shiny look so often seen in Vienna bread.

White milk bread is made with best flour, milk, water, yeast, and salt. For 8 lbs. of flour mix 3 pints of warm water with 3 pints of milk, dissolve in this 3½ ozs. compressed yeast and add a little of the flour to make a ferment. After about an hour add the rest of the flour and 1½ oz. of salt. Knead thoroughly, and let the mass lie for two and a half hours, then work off, prove, and bake.

Home-made bread is usually made in a large earthenware pan or trough, in which the flour is placed, a large hole being left in the middle. A suitable quantity of yeast (according to its strength and the quantity of flour) is mixed with warm (not hot) water, and then poured into the hole. The flour is mixed gradually into it until it becomes a thick batter, then a little flour is sprinkled over the top, and the pan (which should be in a warm place) is covered with a thick cloth and allowed to stand for an hour or two until the yeast has risen well up to the top of the flour. Warm water with a little salt in it is then added, but not sufficient to make the dough when handled stick to the hands. The whole mass is well kneaded, and the dough is then covered up and left to rise. When it has risen to about double its bulk it is again kneaded thoroughly, and after a second rising is made into loaves and baked for about two hours either in tins or on the bottom of an oven, the latter form being called "cottage" loaves. The oven must not be opened while baking. Sometimes a tea-spoonful of carbonate of soda is added to the yeast; and some people mix a little finely-mashed potatoes with the flour before kneading, to add, as they suppose, to the "lightness" of the bread, although the use of potatoes in bread-making is dying out. Another way is to make a batter of the flour, yeast (less than in the previous case), and water, and leave this

for a night to ferment; then add more flour and knead, and proceed as in the foregoing.

Aerated bread is made without yeast, the requisite porosity being produced by kneading the flour, under strong pressure, with water charged with carbonic-acid gas. This, of course, is effected in special apparatus. When the pressure is removed the gas expands, and so produces a uniform porosity throughout the mass of the dough. During baking further expansion occurs, and to allow of this it is necessary to prevent the top crust forming too soon; hence special ovens, baking chiefly from the bottom, are employed.

Self-raising flour is another means of obtaining "light" or porous bread without using yeast. Such flour is a mixture of ordinary flour with some kind of "baking-powder".
 Self-raising
 Flour and
 Baking-powder. Usually the powder consists of about 8 parts of bicarbonate of soda, 6 parts of tartaric acid or cream of tartar, and rice flour to cheapen the cost; but sometimes the rice is omitted, and the tartaric acid or cream of tartar may be replaced by acid phosphates of lime and potash. In any case the principle involved is always the same: the tartaric acid or phosphoric-acid compound attacks the bicarbonate of soda and liberates carbonic-acid gas from it; and this gas then becomes disseminated in bubbles throughout the dough, producing the requisite porosity.

Baking-powder.—To give an idea of the quantities of the ingredients employed, it may be stated that one make of "self-raising flour" contains 23 grains of sodium bicarbonate and 46 grains of cream of tartar per pound of flour. Another common recipe for baking-powder is $\frac{1}{2}$ lb. tartaric acid and $\frac{3}{4}$ lb. each of sodium bicarbonate and arrowroot or potato farina, mixed. The ingredients have to be thoroughly and minutely mixed, and should be kept together in bottle some time before use.

In a Bulletin from the Canadian Government Laboratory, Mr. A. M'Gill reports upon a special investigation of baking-powders, with the following conclusions:—

1. The best and safest baking-powder is a mixture of good cream of tartar with a proper proportion of bicarbonate of soda, and about 15 to 20 per cent of pure starch.
2. Carbonate of ammonia, if pure, and consequently entirely volatile at the temperature of the oven, is a perfectly admissible substitute for the above.

3. Tartaric acid, with the proper proportion of bicarbonate of soda, and somewhat more starch than is required in the case of cream of tartar, is probably a harmless mixture, and may have good leavening qualities if not too long kept. I offer this opinion with some hesitation, since I am uncertain as to the physiological properties of di-sodium tartrate.

4. Superphosphate of lime, when practically purified from the sulphate of lime, which is a by-product in its manufacture, and when also practically free from neutral calcium phosphate (bone-ash, &c.), the raw material used in its manufacture, is probably a harmless substitute for cream of tartar in baking-powders. The sodium phosphate resulting is quite harmless, and the tri-calcic phosphate formed is probably in too small quantity to be injurious.

5. Alum is entirely objectionable as a substitute for cream of tartar, and ought not to be allowed a place in any well-appointed bakery. Not only is the resulting sulphate of soda a powerful purgative, and certain to interfere with normal digestive processes when habitually taken into the system, but the alumina, set free by the reaction of the powder, is capable of rendering insoluble and unavailable the phosphoric acid and phosphates naturally present in food.

6. Alum phosphate powders are more objectionable still than the foregoing, for reasons given in the body of the report.

7. Bisulphate of potash is objectionable as a substitute for cream of tartar on account of the purgative character of the residue left after its action in baking.

"Wheat-meal" or "*whole-meal*" bread is claimed to possess greater nutritive properties than ordinary white bread. The "middlings" and "pollards", which are removed from the fine flour during grinding, contain a considerable amount of flesh- and bone-forming substances. In "wheat-meal" these are utilized, since the middlings and pollards are not separated from the fine flour. Only the bran or coarser outer integument is removed from the grain, and the grinding is done between steel rollers in order to avoid the production of rough edges upon the particles of husk remaining in the meal, since these rough edges are liable to have an irritating effect upon the internal organs during digestion.

Brown bread (ordinary) is popularly supposed to be made from wheat which has been ground entire, or with only a portion of the outer husk removed. It appears, however, to be often produced by simply adding a proportion of pollards or fine bran to ordinary flour during the baking process.

Gluten Bread.—This is made from gluten flour—that is, flour from which much or most of the starch has been washed out. It is chiefly in request by diabetic persons, to whom the starch is objectionable on account of its being a sugar-furnishing substance.

Germ Bread.—This is prepared from flour containing a large

proportion—25 per cent or so—of the “germ” of wheat grain. In ordinary flour the “germ” is absent; it is, in fact, one of the objects of the miller to get rid of it, because the germ contains a bitter principle and a ferment which tends to produce heavy bread. But it has been found that by a certain special treatment with steam the ferment can be destroyed and the bitter principle removed, so that what was formerly a waste product of the miller, as far as flour was concerned, can now be used for bread-making. The germ, being highly nitrogenous, has a high food-value. It yields a very nutritious and easily-digested bread, of fine flavour and good texture. One of the forms of germ bread is *Hovis Bread*.

Vienna Bread.—By “Vienna” bread is generally understood small fancy bread of almost any kind. Properly made Vienna bread, however, is characterized by having a brown **Fancy Bread.** shiny crust, and a fine, sweetish, or “nutty” flavour. To obtain the glossy crust, steam is injected into the oven, and this forms with the dough on the surface of the loaf a kind of gum or dextrinous compound, which hardens into a glaze when the bread cools. Special steam ovens (Vienna ovens) are used, but on a small scale the same results are obtained by placing a long-spouted kettle in the mouth of an ordinary baker’s oven, and passing steam in from this. Flour-washes are also used where no steam ovens are available, the wash being brushed on to the partly-baked bread, and the baking then completed. The sweet, nutty flavour is partly obtained by the use of malt-extract in the dough, the ferment or “diastase” of the malt converting a portion of the starch into sugar. Partly, also, it is produced by the use of sugar, milk, and butter in the dough. One recipe for Vienna bread is as follows:—

Hungarian flour, 10 lbs.; American spring flour, 6 lbs.; patents or whites flour, 4 lbs.; milk, 2½ quarts; water, 2½ quarts; salt, 4 ozs.; butter, 1 lb.; malt-extract, 4 ozs.; sugar, 4 ozs.; distillers’ yeast, 8 ozs.

“Heavy” Bread.—During the fermentation of the dough another change may occur besides the transformation of starch and sugar into alcohol and carbonic acid. An action is set up in the nitrogenous compounds, whereby *they* also act as ferments to the starch, converting it by the action of their diastase into dextrin and sugar, or sometimes into lactic acid. This may be carried to such an excess as to be detrimental to the bread, and

it is always a cause of a dark, heavy, tenacious, and saccharine loaf. Wheat harvested in a bad condition, or exposed during harvesting to much wet weather, yields flour predisposed to the diastasic state, whereby the starch-cells burst and become converted into dextrin and maltose sugar, with the result of giving bread which is sodden, sweet, and sticky.

Certain additions to the flour and yeast before or during the baking process are not regarded as adulteration. Thus a small quantity of *salt*, about $1\frac{1}{2}$ per cent, is almost invariably added, and is considered essential by most bakers. Flour for "self-raising" bread, too, contains baking-powder; and if sold as a self-raising flour is not looked upon as adulterated, provided always that the ingredients themselves are not injurious to health. But if such a flour contained, say, a large excess of tartaric acid, the vendor might be liable to prosecution. Potatoes, boiled and mashed, are very frequently added, but this is an adulteration, and proceedings would no doubt follow where the use of large quantities was proved. But generally the amount is very small—less than 1 per cent—and the object of this is to facilitate the fermentation rather than to obtain an unfair profit. The starch of the potato is gelatinized by the boiling, and it is then more readily acted on by the yeast, so that the use of potatoes is conducive to a quicker fermentation. Farinaceous substances, such as rice, bean, pea, and rye-flour, and mineral matters like chalk, gypsum, and magnesium carbonate, have at one time or other been found as adulterants of flour or bread. A case of using copper sulphate to improve the colour of bread was also reported a short time ago. But practically the only mineral adulterant met with at the present day is alum. This substance increases the porosity and the whiteness of the bread, especially in the case of inferior flour. Since it thus tends to deceive the public as to the quality of the flour used, alum is always regarded as an adulterant, irrespective of any medical question about its wholesomeness or unwholesomeness. Taken in quantity, alum is no doubt an astringent. But on the other hand it is claimed that small proportions of alum prevent the bread becoming sour, and so serve a useful purpose.

Alum.—To detect alum in bread and flour a well-known test with tincture of logwood is commonly employed, which is thus

Adulterations
of Flour
and Bread.

described by Dr. James Bell:—The reagents required are a recently-prepared tincture of logwood and a solution of carbonate of ammonia. The former is obtained by digesting 5 grams of logwood chips in 100 cubic centimetres of strong alcohol, and the latter by dissolving 15 grams of carbonate of ammonia in 100 cubic centimetres of distilled water. For bread the test is applied as follows. To about a wine-glassful of water in a porcelain basin 5 cubic centimetres of the tincture of logwood and the same quantity of the carbonate of ammonia solution are added. A piece of the crumb of bread, say about 10 grams, is then soaked therein for about five minutes, after which the liquid is poured away, and the bread is dried at a gentle heat. If alum be present the bread will acquire a lavender colour, or one more or less approaching dark-blue, according to the quantity of alum which has been added; whereas if the colour be a dirty brown, the bread may be regarded as pure.

A grocer needs to keep his bread as fresh as possible. He should therefore keep loaves together, and not break them off until they are about to be sold. A well-ventilated cupboard or
 Bread Storage. pantry should be used for bread storage. It should not be in a current of air, or it will dry and harden too quickly, and so become unsaleable. Keep all odours away from it.

With regard to selling bread, the law in England is that all bread except "fancy" bread must be sold by weight, and if a loaf is deficient it must be made up to the exact weight by cutting a piece off another. In Scotland loaves must be made 2 lbs. in weight, or else 4 lbs. In Ireland bread must be sold by weight, but the loaves may be of any weight.

The manufacture of Biscuits in this country has now become a very important industry, and the number of different sorts produced is said to be over six hundred. To a
 Biscuits and their Manufacture. large extent the development of the trade is, no doubt, due to the very general use of machinery in the business. One of the English delegates to the Paris Exhibition a few years ago mentions that, by the aid of an Automatic Wafer-maker exhibited there, a single operative was able to manufacture tens of thousands of sugar-wafer biscuits in a few hours. With some few exceptions, it may be said that in the biscuit trade machinery does almost everything but buy and sell.

It carries the work right through, from the mixing of the raw materials until the biscuit is placed in the tin. The biscuit-maker's working ingredients are flour, sugar, salt, butter, lard, margarine, carbonate of soda or ammonia, milk, and water, with various special ingredients such as almonds, eggs, and flavouring substances. In sea-biscuits, which are the simplest kind, the materials consist of flour, water, and salt only. The quality of the flour is not of so much importance as in bread-baking; for, unlike bread, in which whiteness is accepted as a sign of excellence, biscuits are not regarded as improved by excessive paleness. For the most part "soft" kinds of flour are used; but in some varieties of biscuits, especially the cheaper and more bulky kinds, "strong" flours are employed. "Biscuit" flour of the softest kind is generally used for the finest makes of such products as *Tea*, *Wine*, *Marie*, and *Paris* biscuits; but it would not be very suitable for the farthing and halfpenny large biscuits sold in poor localities, where the purchaser likes to see plenty for his money.

In substance the process of biscuit-making is yet more simple than that of bread, since all that is needful is to well mix the flour with the water or milk, and to add salt, butter, sugar, and flavouring or colouring ingredients until a dough of the requisite consistency is produced, which dough is afterwards moulded and baked. Without going into minute detail, the machinery actually employed to carry out these operations in practice may be summarized as follows:—

(1) **Mixer.**—This is a cylindrical vessel of cast-iron, in which are revolving knives or arms: these thoroughly mix the flour, water, &c., into dough. The revolution of these knives is sufficient to incorporate the materials thoroughly into a very stiff dough in about seven minutes.

(2) **Brake Machine.**—This consists essentially of a pair of heavy iron rollers, between which the dough is passed backwards and forwards until it is rolled out into a uniform plate.

(3) **Cutting and Panning Machine.**—Here the dough at first passes under gauge rollers to get it of the required thickness, and then under a punching apparatus, the dough being carried forward on a web of felt. This punching apparatus is fitted with moulds or cutting edges of the desired form for the biscuits, which

are cut out by the pressure of the mould descending against the felt. The biscuits are then carried along on the web until they fall into tin trays, which are passed on by a travelling stage to the oven. In some cases the ovens are fed direct by the cutting and panning machines.

(4) **Ovens.**—As an example of these the patent travelling ovens may be mentioned. They are about 10 to 15 yards long, and fitted with endless webs of either plates or chains. The plates are for such goods as large water-biscuits, which are placed on them by hand; the chains carry small and fancy biscuits, such as are placed in trays. The rates at which biscuits of different sizes and degrees of richness must pass through the oven vary from about five to forty minutes, and the temperature of the oven is modified to suit the various qualities. Both the heat and the motion are under easy control.

In the richest class of articles, the dough for which is necessarily soft, the biscuits are cut out by hand labour and "fired" on trays in common ovens. For *rout* biscuits the dough is placed in a strong metal chamber fitted with a piston moved by a screw; this pushes the dough through a series of holes or dies, whence it is received on a sliding board and cut into proper lengths with a knife.

A few descriptive remarks upon some of the leading kinds of biscuits are given below:—

Abernethy.—Made from flour and milk, and flavoured with caraway seeds. They are thin, fine, round biscuits, of various sizes—*e.g.* those usually sold at a penny, a halfpenny, or a farthing each. They take their name from the town of Abernethy in Scotland.

Almond Drops.—An average mixture for these is $4\frac{1}{2}$ lbs. flour, $1\frac{1}{4}$ lb. margarine, $\frac{1}{2}$ lb. of baking-powder, and $4\frac{1}{2}$ lbs. of sugar. These ingredients are well rubbed up together, and then mixed with 14 eggs and a little essence of almonds. The paste is rolled into long fine strips, cut up into $\frac{1}{2}$ -inch pieces, and baked in a cool oven, the pieces being placed on end half an inch apart.

Arrowroot.—Rather sweet biscuits, of various sizes, and either circular or oval in shape. They may be pricked or not pricked, and with either a plain or a figured border.

Gingerbread is made with wheat-flour, treacle or syrup, sugar,

Some
Varieties of
Biscuits.

butter, and eggs, the flavouring ingredients being ginger, mixed spice, and lemon-peel. Tartaric acid and carbonate of ammonia are sometimes used to make the gingerbread light and spongy. The top is usually glazed with a solution of gelatine (1 oz. gelatine dissolved in 1 pint of water), brushed on as soon as the gingerbread is drawn from the oven. A simpler recipe is: Mix 6 lbs. flour and a little ground ginger with 3 pints of treacle, and knead into a stiff paste.

Scotch gingerbread is made as follows:—For the materials take 9 lbs. flour, 6 lbs. golden syrup, $2\frac{1}{2}$ lbs. butter, 3 lbs. moist sugar, 1 oz. ground nutmeg, $1\frac{1}{2}$ oz. mixed candied peel, 8 ozs. chopped almonds, and about 16 drops of pear essence. Simmer the butter and sugar with the syrup, allow this to cool, and then mix the dry ingredients with it. Make the paste into 3- or 4-lb. blocks, and bake in a solid oven. If wanted lighter, add 1 oz. cream of tartar and $\frac{1}{2}$ oz. bicarbonate of soda to the materials mentioned above.

Bengal nuts, Bon-bon biscuits, Lemon nuts, Rifle nuts, and Victoria nuts are all varieties of gingerbread.

Cracknels are made without either milk or water being used to mix the dough, eggs alone being employed for this purpose. Certain proportions of butter, sugar, and carbonate of ammonia are added to the mixture of flour and eggs, and the dough is baked as usual. The cracknels, when cut out, are thrown into a vessel of boiling water, and in about two minutes they float to the top. They are then fished out and placed in cold water, afterwards being drained on cloths, panned, and fried in an ordinary oven at a high temperature. During the firing the ammonium carbonate, being very volatile, is driven off by the heat, and the cracknel thus assumes its spongy structure. Cracknels are very light, puffy, and brittle biscuits, with a peculiar smooth and shiny surface. **Cup cracknels** are of oval shape, depressed in the centre, and about 3 inches long, $2\frac{1}{2}$ broad, and $\frac{1}{2}$ inch thick. **Fancy cracknels, star cracknels, &c.**, are similar to ordinary cracknels, but cut into various fanciful shapes.

Macaroons.—These are small, very sweet biscuits, with flat bottoms and convex tops. One recipe for them is as follows:—For materials take 2 lbs. ground sweet almonds, 3 lbs. sugar, 2 ozs. rice-flour, 3 ozs. baked flour, and about $1\frac{1}{2}$ lb. of white-of-

egg. Mix the first four ingredients well; add the egg-white, and beat well with a pestle for twenty minutes. Cover the mass, and allow it to stand for half an hour. Spread wafer-paper on sheet tins, and drop out the macaroon paste on to the paper, keeping the drops at suitable distance apart (form a bag with a tube, the opening being about the size of a threepenny-piece); put sliced almonds at top, and bake in a slow oven with the door ajar. Keep the macaroons in a very dry place.

Such substances as ground cocoa-nut, pea-nuts, and rice are also used instead of almonds; but, although the appearance of the macaroons is satisfactory, the flavour is inferior.

Osborne biscuits are a round variety, about $2\frac{1}{4}$ inches in diameter and $\frac{1}{4}$ inch thick; about 55 go to the pound.

Princess Shortbread.—Small cakes of cocoa-nut and chopped almonds.

Promenades are iced and flavoured biscuits, with lemon, chocolate, vanilla, and coffee as the chief flavours.

Ratafia.—These are made by a process very similar to that used for macaroons, but using a smaller tube. One recipe is: $1\frac{1}{2}$ lb. sweet almonds, $\frac{1}{2}$ lb. bitter do., $3\frac{1}{2}$ lbs. brown sugar, 2 ozs. rice-flour, 2 ozs. baked flour, and $1\frac{3}{4}$ lb. white-of-egg. The ratafias, when baked, are lightly splashed over with water by means of a brush.

Rusks.—These are popular on account of their supposed digestibility and wholesomeness. There are several varieties, but the essential ingredients in all are the same, viz., flour, milk, butter, and sugar—much the same mixture, in fact, as is used for tea-cakes. The rusks are made very light and spongy, and cut into particular shapes and slices. In baking they are first browned on both sides, and then finished for three or four hours in a slower oven.

One recipe for rusk-making on the small scale is as follows:—The materials are 1 lb. flour, 2 ozs. butter, $\frac{1}{4}$ pint milk, 2 ozs. powdered loaf-sugar, 3 eggs, and 1 table-spoonful of yeast. Put the milk and the butter into a sauce-pan, and keep shaking it well whilst warming until the butter is melted. Place the flour in a basin with the sugar, and mix well. Beat the eggs, and stir them with the yeast into the milk and butter, and with this liquid work the flour to a smooth dough.

Cover the basin with a cloth, and leave the dough to rise by the side of the fire. Then knead it, divide it into twelve pieces, place it in the oven, and bake for twenty minutes. Then take the rusks out, break them in halves, and set them in the oven again to get crisp on the other side.

Rusks should be stored in air-tight tins.

Sea-biscuits.—These are chiefly made at the Government victualling-yards, for use in the navy. They are the simplest kind of biscuit, being composed of flour, water, and salt only; and are baked slowly, to ensure uniform dryness and hardness of texture. They have the merit of being able to resist the action of atmospheric moisture to a considerable degree. When stored in a dry, warm place to become thoroughly "cured", and kept out of contact with the external air, they will keep good for years.

Shortbread is a kind of crisp, flavoured tea-cake. It is made of flour and butter, or lard, sometimes plain, but often flavoured with citron and chopped almonds, or ornamented with caraway comfits. Scotch shortbread for transmission to England or abroad is generally made very rich.

Tea-biscuits.—One recipe for these is: 4 lbs. sifted flour, 4 ozs. German yeast, 1 pint of milk, 6 ozs. melted butter, 1 table-spoonful salt. Set the sponge, and when raised add the butter and salt. Make a light dough; let it rise once, then make into biscuit. Place these upon biscuit plates, set in warm place till light, and bake in a good oven.

Water-biscuits.—These are thin white biscuits of circular form, about 3 inches in diameter and $\frac{1}{4}$ inch thick. Each has some 25 to 30 small holes pricked through it. The biscuits are made of flour, water, and salt. In some districts, as in the west of Scotland, "strong" flours are used; the biscuits then "spring" better, are more flaky in appearance, and are more easily broken. In England, however, and in some Scotch factories, soft flours are employed, and the water-biscuits then are hard and crisp.

In the "firing" of biscuits, not only is the moisture of the dough driven off, but a certain proportion of the water held by the flour in its apparently dry state, so that only about 9 lbs.

of water-biscuits are obtained from 10 lbs. of flour. The composition of plain biscuit is as follows:—

Water	...	...	...	8 to 12 per cent.
Nitrogenous substances	...	...	...	15 "
Dextrin, fat, and sugar	...	...	...	6 to 7 "
Starch	...	...	...	72 to 75 "

Ordinary biscuits are very convenient foods in respect of portability and keeping qualities. They contain a larger proportion of nutriment than the same weight of bread does; but they are more difficult to masticate, and, by reason of their dryness, more difficult to digest when eaten. Hence, notwithstanding their greater nutritive value, plain biscuits are not preferred to good bread when the two are equally available.

Biscuits should always be kept as dry as practicable, since moulds are very prone to develop upon them if they become damp. Spores of the fungus *Penicillium glaucum* and allied varieties are very common in the air, and if these fall on softened nutrient surfaces such as moist bread or biscuit they are liable to develop at a rapid rate and spoil the articles. Hence biscuits should be kept covered up to keep the spores off as far as possible, and stored in a dry place to prevent the development of any spores that may in any case have fallen on them. Biscuits made from unsound flour, or which have not been sufficiently dried, are liable to be affected most by the moisture of the atmosphere. The harder a biscuit is dried in an oven the longer it will keep. Rich biscuits are prone to turn rancid if kept too long; this is probably due to the oxidation of the fat or to its decomposition by microbial organisms. Sugar is said to retard the growth of moulds; the more sugar there is the better the biscuit is believed to keep, and for this reason most of the biscuits exported to India and other warm countries are of the "mixed" or sweet kinds. But even highly-sugared *soft* biscuits will become damp if placed long in a moist atmosphere; and the plain, sugarless kinds are readily affected. Ginger-nuts and water-biscuits alike suffer unless they are kept dry.

Excessive paleness or whiteness is not considered a good feature in biscuits; it is usually suggestive of age or of imperfect baking.

CAKES.—The chief materials used in cake-making are so well known that it is scarcely necessary to do more than formally mention them. As **staple ingredients** the baker uses flour, sugar, butter or margarine, eggs, and milk. Very often, especially for the lighter kinds of cake, **baking-powder** or “volatile salts” are employed, the latter substance being carbonate of ammonia. For **colouring ingredients** turmeric and saffron are frequently used, the saffron being generally preferred on account of the more uniform distribution of the colour obtained with it. “Liquid saffron” is the form in which it is usually employed; this is prepared by boiling half an ounce of saffron powder with half a pint of water for a few minutes. The infusion thus made is bottled and used as required, a few drops generally sufficing for ordinary quantities of flour. **Spices** are, of course, common in cakes: the principal are cinnamon, mixed spice, nutmeg, and essence of spice. For particular kinds of cake there are also the special **characteristic ingredients**, as, for example, raisins, currants, almonds, seeds, peel, cocoa-nut, and so on. The flour used should be of good quality, though for the commoner kinds of cake it need not be of the best, and usually is not. For high-class goods, however, superfine white flour and castor sugar ought to be employed. The butter should not be salt or rancid. As a general rule the butter and sugar are well “creamed” together before mixing with the other ingredients. This “creaming” consists in gently warming the mixture of butter and sugar so as to soften the butter, but not to actually melt it, and then beating it up until it forms a thick white cream. The eggs are then added, one or two at a time, and beaten up well with the butter and sugar after each addition. Some typical recipes are appended, to illustrate the procedure and the ingredients used in the production of some principal varieties of cakes.

Good Cheap Lunch-Cake.—Cream up $\frac{1}{2}$ lb. of butter and $\frac{1}{2}$ lb. of sugar as described above, then add 2 eggs and beat well. Dissolve 2 tea-spoonfuls of bicarbonate of soda in a quart of warmed new milk; also take 3 lbs. of flour and $1\frac{1}{2}$ lb. of raisins, and then thoroughly mix the whole of these ingredients with the creamed-up butter, sugar, and eggs. Bake the cake in a slow oven.

Pound-Cakes.— $1\frac{1}{2}$ lb. of flour, 1 lb. of butter, 1 lb. of sugar,

1 $\frac{1}{4}$ lb. of eggs, and 1 lb. of mixed currants, sultanas, and peel, with a little carbonate of ammonia. Proceed as before, commencing by creaming the butter and sugar, then adding the eggs, and afterwards the other materials. Variants of this cake are made by using dried cherries, allspice, cinnamon, &c., in addition to, or replacing some of, the other ingredients named.

Madeira-Cakes. — 1 $\frac{1}{2}$ lb. each of butter and castor-sugar, 2 lbs. flour, and 2 $\frac{1}{4}$ lbs. of eggs. The butter and sugar are "creamed", and the eggs added and flavoured with a few drops of essence of lemon; the flour is then stirred into the mixture, but without further beating. Madeira-cakes are generally baked in round hoops or tins, papered. Before putting in the oven some fine sugar is dusted over them and slices of citron-peel placed on the top. Other varieties of Madeira are made in which powdered cinnamon and "volatile salt" are used; whilst some have lemon-peel, nutmeg, and brandy as ingredients.

Genoa-Cakes. — 4 lbs. of flour, 2 lbs. each of butter, sugar, and currants, 3 lbs. sultanas, 1 lb. of peel, and 20 eggs; also $\frac{1}{2}$ oz. each of cream of tartar and bicarbonate of soda sifted with the flour. The butter and sugar are creamed as described, and the other ingredients mixed therewith.

Genoa-cakes are generally baked in square tins, and have chopped almonds sprinkled thickly on the tops. In cheaper kinds the almonds may be omitted. Other varieties include nutmeg, mixed spice, and rum as constituents.

Seed Genoa is a cake similar to the above, but with the fruit replaced by caraway seeds.

Sponge-Cakes. — $\frac{3}{4}$ lb. castor-sugar and 1 lb. eggs are whisked up together continuously for half an hour. During the whisking the mixture encloses innumerable air-bubbles and forms a light, frothy mass. About 4 drops of essence of lemon are now added, and then $\frac{3}{4}$ lb. of previously-sifted flour is carefully mixed in. Excessive stirring is avoided at this stage, as it would break down the air-bubbles and render the cake heavy.

Tea-Cakes. — These differ from the foregoing in being fermented as well as mixed with butter or other fat. One good recipe is: 6 lbs. flour, 12 ozs. lard, 8 ozs. sugar, 3 ozs. yeast, $\frac{1}{2}$ oz. salt, and 1 $\frac{1}{2}$ pint each of milk and water, with a few drops of essence of lemon. The ingredients, after mixing as

usual, are set to ferment at a temperature of about 90° F. (a few degrees below blood-heat), and are then made into a "slack" dough. The cakes are baked in round hoops, and are afterwards brushed over with a little egg-wash. These cakes are sometimes sold as *Brioche*; and also, in small loaves, as *tea-bread*.

Hot-cross Buns.—Twelve quarts of water, 3 lbs. butter, 3 lbs. lard, 1 quart eggs, 6 ozs. yeast, 6 lbs. sugar, sufficient currants, 6 ozs. mace, 4 ozs. salt. As a sponge is desirable, set it with 8 quarts water, 6 ozs. yeast, and add 4 quarts water in making dough.

Brioche is strictly a slightly-sweetened, rich bread or cake, compounded of a fermented or an aerated dough and a butter-and-egg stirred dough; but confectioners often sell brioche as a kind of bun with sweet syrup poured on it; and compound fancy brioche contain cherries, peel, pine-apple, angelica, and a liqueur. These are made up with dough into a ball or nucleus, and surrounded by a plain sweet dough.

"Icing" of Cakes.—The icing used for ornamental purposes is merely the finest sifted loaf-sugar (icing sugar) worked up into a soft paste with white-of-egg and a little lemon-juice; and either coloured or left plain. For almond icing, the whites of 3 eggs are worked up with 12 ozs. of icing sugar, and into this is gradually mixed 8 ozs. of blanched sweet almonds previously pounded to a smooth paste. Cocoa-nut icing is made in a similar way, substituting cocoa-nut for the almonds. Chocolate icing is prepared by mixing melted chocolate-paste with white icing.

19. CONFECTIONERY

Sweets, fancy fruits, bon-bons, and fancy chocolates may be taken to represent "confectionery". In imparting variety to his simple sugar the confectioner employs colouring and flavouring. It may be convenient to mention here the chief ingredients which are used for these two purposes:—Colouring substances.—Vegetable products: Saffron, turmeric, logwood, fustic, Brazil wood, and cherry red. Animal products: cochineal and carmine. Manufactured products: Prussian blue, magenta, and various

other aniline colours. The last-named are now largely used, some large confectioners employing little else. Flavouring
 Colouring and substances.—(1) *Essential oils* of almond, aniseed,
 Flavouring bergamot, caraway, cassia, cinnamon, cloves, citron, lavender, lemon, nutmeg, orange, orris, peppermint, and verbena. (2) *Fruit essences*, such as apricot, blackberry, cherry, cowslip, currant, damson, peach, pear, pine-apple, plum, raisin, raspberry, strawberry, vanilla, &c.

The number of individual kinds of sweets is so great as to be somewhat confusing, but they may be for the most part grouped
 Sweets. into a few leading lines. We may class them as *lozenges*, *comfits*, sweets of the *sugar-candy* and *fondant* type, and *barley-sugar* sweets; with a few sub-types such as *pastilles* and *toffees*. The following is a short description of these various branches of confectionery.

Lozenges.—The simplest form in which sugar is prepared as a sweet for eating is that of lozenges. These are merely refined sugar ground to a very fine powder, mixed with dissolved gum, and flavoured with essential oils or other ingredients.

Fine loaf-sugar is ground to an impalpable powder between millstones, mixed with sufficient solution of gum-arabic to form a very stiff dough, and the whole is then thoroughly incorporated by a mechanical mixer. This paste is rendered homogeneous and reduced to a uniform cake by repeatedly passing it backwards and forwards between heavy metal rollers, the surfaces of which are prevented from adhering to the paste by being dusted with starch flour. The cake, when sufficiently spread out, is transferred to a piece of tough web-paper and passed under a frame of cutters of the size and form of the lozenge required. These punch out and take up the lozenges. When the tubes forming the cutters are filled, the whole frame is turned over and the cut-out lozenges emptied into a tray. After this the lozenges only require to be dried and hardened, which is effected by placing the trays in a heated room until the sweets are of the desired texture.

Lozenges are coloured and flavoured with a great variety of ingredients, such as ginger, peppermint, black currant, &c. These are added in the requisite proportions to the dissolved gum when the latter is mixed with the sugar.

Medicated lozenges are prepared in the same way, the various medical ingredients, such as chlorate of potash, bismuth, chlorodyne, sulphur, &c., being similarly incorporated with the gum.

Comfits or hard confections form a second leading variety of confectionery. In order to form comfits a core or centre of some kind is always required; this may either be a seed, as a coriander or caraway, or a fruit, such as an almond; or Comfits. it may be a small lozenge, as in the making of "pan drops"; or sometimes a very small globular sweet, as in the preparation of "rifle balls" from "hundreds and thousands" (nonpareils). Around such cores successive layers of sugar are deposited, and the sweets can thus be made of any desired size.

This building up of the comfits is accomplished thus: the cores are placed in copper vessels, which are so placed and geared as to be inclined at an angle of about 45 degrees from the horizontal whilst at the same time they are caused to revolve. By their revolution the contents are kept constantly in motion, tumbling over one another. The copper pans are kept hot by a steam jacket, and a quantity of pure strained sugar syrup is poured in on to the cores. The latter thus become coated with the syrup, which gradually dries by the heat, and leaves the cores with an envelope of sugar. On account of the continual motion the comfits do not stick together, but become rounded by the rolling movement into so many separate balls or eggs. More syrup is added after the first coat appears to have sufficiently dried, and this is repeated until a certain thickness of sugar has been produced, when the comfits in process of manufacture are removed, and put aside to dry and harden for a time. If not then of the required size they receive further alternate coatings and dryings until they attain the size wanted, after which they are finished by giving them a final coating of thin syrup, which may be coloured if desired, and subjecting them to long-continued friction in the pan. The comfits are then hardened in a drying-room and are ready for use.

A great variety of seeds and fruits are used as the cores; such, for example, as almonds, caraways, corianders, cloves, cassia, pistachios, and perfumed cherry kernels.

We next come to sweets of the *sugar-candy* type, including the candy itself and various fancy candies such as ginger-candy,

cocoa-nut candy, and so on, which are flavoured with the material indicated by the name. **Sugar-candy** is simply sugar which has been crystallized in a special way, and is either coloured or left white. A usual method of manufacture is to concentrate pure sugar syrup until it has a high specific gravity (1.42 to 1.45) and then to run it into cones made of copper, through and across which a number of threads are passed. The cones are gently heated with hot air, and the sugar gradually crystallizes on the threads. The process is rather slow, from a week to a fortnight being occupied in the crystallization.

White candy, when made from pure loaf-sugar, contains about 80 per cent of crystallizable sugar and 20 per cent of water. It is much used in the manufacture of artificial champagne.

Coloured candies are of various hues, two of the most frequently met with being "pink" candy and "light-brown" candy; but all shades of yellow, brown, and red occur. Pink candy fetches a higher price than either white or brown. The coloured candies may contain a good deal of uncrystallizable sugar, as well as the colouring matter, which is sometimes mineral, sometimes vegetable, and sometimes an aniline product, but which is nowadays rarely used in such quantity or of such character as to be deleterious. Either brown or white sugar is used for coloured candies.

Candy which has become dull and dirty may be cleaned and brightened by brushing it quickly over with water, and then immediately wiping it and drying it in front of a fire.

Belgium, Holland, and Germany chiefly supply the candies which are most frequent in England. They are commonly classed as white, pale, straw-yellow, yellow, dark-yellow, light-brown, brown, and dark-brown.

Fondants are made from sugar syrup evaporated down to the crystallizing point, properly coloured and flavoured, and then cast into moulds made of starch. The different kinds of *Sugar Drops* are prepared from fine sugar syrup, mixed with a small proportion of colouring matter and the desired flavouring. The mixture is dissolved by heat without allowing it to boil, and then poured in separate drops on a sheet of paper. The drops quickly set and harden. Cherry, clove, ginger, honey, lemon acid, pear, pine-apple, raspberry, and strawberry drops are some of the chief kinds prepared in this way.

Barley-sugar.—The basis of another extensive variety of confectionery is furnished by what is termed "*boiled sugar*"—that is, sugar which has been boiled until, on cooling and hardening, it assumes a glassy appearance and fracture. Boiled Sugar. Of this class *Barley-sugar* is the type, as it is the simplest example. It consists merely of sugar boiled as above indicated, flavoured with a little oil of lemon, poured on to a marble slab, and rolled or twisted into sticks.

Boiled sugar is prepared in innumerable fanciful forms by passing it, while still in a viscous condition, through small machines in which a pair of brass rollers, having patterns sunk in their surface, stamp these patterns into the plastic material. It is also worked up into the form of balls, plaited into coils, formed into parti-coloured sticks, and so on.

By vigorous and long-continued drawing out of boiled sugar while it is in a plastic condition the molecular structure of the material is changed, and from being glassy and transparent it becomes opaque, porous, and granular in appearance and fracture. In this condition it forms what is known as "*Rock*", of which there are several varieties, such as maple rock, almond rock, &c., depending upon the flavouring ingredient.

Pastilles are preparations containing large proportions of gum or gelatine, in a solution of which the sugar is dissolved. They are usually tinted and flavoured with fruit essences.

Toffee and **Butter Scotch** are made by boiling sugar, honey, and butter together, though frequently the honey is omitted.

Caramels are prepared by boiling sugar, cream, glucose syrup, and butter together until the mixture will set hard on cooling. Various flavouring substances are added whilst the ingredients are still hot: thus vanilla caramels, rasp- Caramels and Jujubes. berry caramels, and strawberry caramels are produced by using the corresponding essences. After the mixture has been poured out on a flat surface and cooled somewhat, it is cut up into squares.

Jujubes are manufactured by boiling down sugar syrup and glucose, and then dissolving in the hot mixture a quantity of previously-soaked gelatine and a little tartaric acid. The proper flavouring is then added (*e.g.* essence of lemon for lemon jujubes), and any desired colouring substance such as cochineal. The

mixture is poured out to form a sheet, and cut into patterns with a machine or scissors.

Gelatine goods can be "crystallized" (*i.e.* covered with sugar crystals) by simply dipping them while soft into white sugar.

Liqueurs are sugar which has been boiled to the proper degree of concentration, coloured with colouring ingredients, and flavoured with the proper essence or liqueur (*e.g.* brandy or brandy essence for brandy liqueurs). The mixture is run into moulds, and afterwards "crystallized" by being placed in warm sugar syrup for some hours; at the end of which time the excess of syrup is drained off and the sugar on the surface of the liqueurs becomes a coating of crystals.

Nougat is a confection which has as its basis some kind of nut, such as almonds, pistachios, or filberts, with honey as its proper saccharine ingredient, though of late years sugar has largely taken the place of the honey. **Marseilles White Nougat**, for instance, consists of almonds and pistachios boiled with Narbonne honey.

The term "*bon-bons*" is applied to several varieties of articles. In a general sense it means "goodies", sweets, or sugar-plums;

but there are also more specialized uses of the word.

Bon-bons. Thus "bon-bon" biscuits are a kind of gingerbread; and the modern English usage of the term "bon-bon" ordinarily has reference to "cosaques" or Christmas crackers, consisting of gorgeously-packed sweets, mottoes, and other articles. "**Parisian Bon-bons**" are certain fancy confections of various kinds, including preparations both of sugar only and of fruit and sugar. With these are usually grouped other fancy sweetmeats of more or less allied forms, such as abricotines, dragées, fondants, fruits fourrés, legumes surfines, chocolate liqueurs, marzipan, nougat carré, nougat à la Pistache, nougatines, Trocadero's patisserie, and vanilla almonds, as well as various chocolate preparations. The general character of these sweetmeats has been indicated in what precedes.

Fancy Chocolates include a considerable variety of products, chief among which may be mentioned chocolate creams, cream cakes and bars, chocolate drops, buttons, fondants, caramels, croquettes, almonds, nougat, and bon-bons; together with various kinds of flavoured articles, such as milk, vanilla, and Spanish

chocolates. For a description of these latter see the section "COCOA AND CHOCOLATE". Here we deal more especially with the former varieties, those, namely, into which, ^{Chocolates and Creams.} as a rule, sugar enters, not merely to sweeten the chocolate paste, but as a separate component of the sweetmeat.

In the manufacture of these fancy chocolates the actual *modus operandi* differs a great deal in the various factories; but the nature of the operations will be gathered from the following examples.

Chocolate Creams.—The common form of chocolate cream consists of an inner core of white, sweet "cream", surrounded by a shell of chocolate. The core is very frequently a mixture of sugar and cocoa-butter; it may, however, consist of sugar alone, which is made into "cream" by special treatment as follows:—A mixture of 8 parts by weight of powdered loaf-sugar, 5 of water, and 2 of glucose syrup is boiled down until it shows a temperature of about 244° F. It is then poured out on to a flat plate and rubbed up with a spatula; this causes it to gradually lose its clear syrupy character and to become quite white and creamy, when it is ready for use. The glucose prevents the sugar from crystallizing: the same object can be attained by using a little acid tartate of potash (cream of tartar) instead of the glucose.

Whichever variety of "cream" is used, the next step is to mould it into the core. Most confectioners use starch moulds for work of this character. Trays with turned-up edges are filled with starch-powder and levelled over, and then solid moulding-shapes of plaster of Paris are pressed into the starch to form the hollow cream-mould. Into these the melted "cream" is filled, and allowed to set. After a time the cores thus made are removed from the starch and cleaned from adherent powder with a soft brush. They are then dipped into melted chocolate paste to give them the outer covering, and set aside to cool and harden. When required to be glazed they are brushed over with a solution of shellac in spirits of wine.

Chocolate Cream Sticks and Cakes.—Like the "creams", these have a core of sugar (or sugar and cocoa-butter), with a jacket of chocolate. They are made in tin or copper moulds of the size and shape of the stick or cake required. In this case, however, the melted chocolate is first poured into the mould, forming a coating

on the bottom and round the four sides, and when this has set, the melted "cream" is run into it. After this has become cold and hard the exposed part of the cream is painted over with chocolate paste.

Chocolate Fondants.—These are made in starch moulds prepared as described for chocolate creams, using the required fondant shapes. In the making of one variety, the moulds are first half-filled with the white "cream" of sugar (or sugar and cocoa-butter), and after this has set somewhat the moulds are filled up with a mixture of "cream" and chocolate paste. This second filling is, consequently, with dark-coloured material, whereas the first portion was white. The white portion may be flavoured with vanilla. When the fondant has hardened it is removed from the starch and "crystallized" by being placed in sugar syrup for a time; the excess of syrup being then drawn off and the deposited sugar forming a coating of small crystals on the fondants.

Chocolate Caramels.—One method of preparing these is to boil together sugar, cream or condensed milk, glucose or cream of tartar, and butter; the mixture being constantly stirred and the boiling continued until the mass is of such a consistency as to become hard when cooled. While the mixture is still hot, cocoa- or chocolate-paste is stirred into it, together with vanilla extract sufficient to flavour it. The molten mass is then poured out on to a plate and cut into squares when nearly cold.

Ordinary confectionery ices and ice-creams may be broadly described as frozen custard or cream, flavoured and sweetened.

Ices and Ice-creams. The congelation is usually effected in a hand freezing-machine, which consists of an outer jacket in which a freezing-mixture of ice and salt is placed, and an inner pewter pot containing the "cream". This inner vessel can be caused to rotate on turning the handle of the machine, the centrifugal force bringing the liquid against the cold sides of the pewter pot, from which it is, when frozen, removed at intervals by means of a pewter "spaddle" or spade and brought into the middle of the pot again. This allows the remaining liquid to reach the sides; and the operation is thus carried on until the whole is frozen.

Common Ice-Cream.—The materials may be eggs, milk, powdered sugar, and butter; using for every quart of milk 4 eggs, 8 ozs. of sugar, and 1 oz. of butter. The eggs are whisked up

and put in the milk with the sugar and butter; the whole is then whisked together and heated gently, with constant stirring, to near the boiling-point and until thickened. This mixture is then strained through muslin, cooled, and frozen in the machine. If a vanilla ice is required, the mixture is flavoured with vanilla essence, and either left white or slightly tinged with saffron; if a raspberry or lemon ice is wanted, the corresponding essence is used for flavouring, and the ice is coloured red with cochineal for raspberry, or yellow with saffron for lemon.

In **Cheap Ice-Cream** the eggs are omitted, and the thickening is supplied by farina or corn-starch. Sometimes gelatine is used.

Dessert Ices.—The basis of these is generally a "cream-custard", which may be prepared from the same materials as the common ice-cream just mentioned, but replacing the milk by cream and omitting the butter. Proceeding in the same way as described for the common cream, the mixture (for freezing) is obtained, and to this the special flavourings are added to give the particular cream-custard ice required. The flavouring consists of various fruit-pulps, extracts, essences, wines, &c. For **Raspberry Ice-Cream**, the fruit is rubbed through a sieve, and 1 pint of the pulp is added to each quart of the cream-custard, after which the mixture is coloured with cochineal and frozen. **Strawberry Ice-Cream** is prepared in a similar way. For **Pine-apple Ice-Cream** peel and bruise a small pine-apple and rub it through a sieve, add the juice of two lemons, and mix the whole with one quart of the cream custard, colouring it with saffron infusion. For **Cocoa-nut Ice-Cream** add to a quart of the custard, as soon as it is taken from the fire, a small cocoa-nut peeled and grated; when cold, strain the mixture and freeze it. **Coffee Ice-Cream** is made by adding strong sweetened infusion of coffee to cream-custard; **Chocolate Ice-Cream** by mixing melted chocolate paste with custard.

Water Ices.—**Common Lemon Water Ice** is made by adding a few drops of essence of lemon and a little tartaric acid to a quart of water, together with the whites of two eggs and 12 ozs. of powdered loaf-sugar. All these ingredients are whisked together and strained through a fine sieve before freezing. **Raspberry Water Ice** is obtained by squeezing the raspberries through a fine sieve, and adding about $\frac{1}{2}$ lb. or so of pulp to every quart of water, with a little citric acid, the whites of two eggs, and sugar.

20. GREEN FRUIT, NUTS, AND VEGETABLES

The green vegetable products with which the grocer and Italian warehouseman are chiefly concerned include apples, bananas, grapes, lemons, melons, nuts, onions, oranges, pines, pears, pomegranates, tomatoes, and potatoes, and various others. Of late years an enormous development has taken place in the fruit trade of Great Britain, and this means also of the world. A quarter of a century ago, if we excepted oranges and lemons, almost the only fruit sold was the home-grown fruit, each kind strictly in its season. A revolution was effected by the discovery, in 1889, of the refrigerating or dry-air process. Within three years hundreds of refrigerator cars were running in the United States and Mexico, and at the beginning of the twentieth century the number was estimated at 60,000. In other countries similar progress has been made, and the system has been applied to steamships as well as railway trains, so that what with cool chambers and fast ships we now have fresh fruit carried not merely across the Atlantic and from the shores of the Pacific, but right across the globe from Australia and New Zealand, to say nothing of the Cape of Good Hope. Very large quantities of green fruit are now annually distributed by grocers, and many members of the trade make a display of such fruits even if they do not launch extensively into the potato business.

Apples.—The Australian apples are on sale from about the end of May to the end of July; Lisbon in July and August; United States in November, December, and January; **Apples.** and Canadian from November to March. There are some five thousand varieties and sub-varieties of apples, but it is not necessary for the grocer to know them all! The British crop averages about 90,000 tons, worth £10 a ton. The renowned sorts for table use are orange pippins, golden pippins, Cox's orange pippins, Kempster pippins, King pippins, Worcester Pearmain, Devonshire Quarrendon, and so on. The famous Ribston pippin has been, it is said, almost carried off by canker. One of the best of all apples is the Blenheim Orange. Early baking varieties are the Codlins and Calvilles; in autumn are the Rennets, Pearmain, and Greenings. The Russets are good-flavoured apples, and amongst good cookers are such as

the Bismarck, Lord Suffield, Potts's Seedling, New Hawthornden, Tower of Glamis, &c. *Australian* apples on the British market are so far mainly Tasmanian and Victorian, and consist of well-known varieties such as Cox's Orange, Sturmer, Ribston, and Blenheim pippins, Emperor Alexander, and other good varieties. The fruits are usually wrapped separately in paper and carefully packed in boxes of uniform size and shape. *American* (Canadian and States) apples include chiefly Russets, Baldwins, Newton pippins, Kings, Canada Reds, Ben Davis, Spys, Spitzenbergs, Greenings, &c. The Ben Davis, of which great quantities are grown in Canada, is a cooking apple which has little flavour of its own but takes readily the flavour of any other fruit cooked with it. Kings come from King's County in Nova Scotia. The Maine and New England farmers have concentrated their attention upon recognized good sorts, and practically ship nothing but Baldwins, Greenings, Ben Davis, and Kings. In a Canadian official enquiry it was advised by experts that the best sorts to ship from Quebec and Ontario were, besides the four named, Fameuse (Snows), Phoenix, Golden Russets, Spy, Rox Russets, Canada Reds, Spitz, and Wagner. During six years, till 1900, Canada exported a little over five and a half million barrels of apples, nearly a half of which went from Montreal. It was formerly a matter of complaint regarding Canadian apples that those in the middle of the barrel were poor companions for those at the top. The Canadian Government has therefore put in force a Fruit Marks Act, amended 1902. This act orders the selecting, grading, and classing of various fruits for export, but especially applies to apples. It directs that the name and address of packer, the variety and grade of fruits contained, shall be legibly displayed on each package; it stipulates that there be not less than 90 per cent of a uniform size and free from blemish, bruises, grubs, and other defects, and that there shall be put up three or more grades; it also forbids the sale of any package not so marked. The Government have been lenient in enforcing the provisions of this act, until its clauses are clearly understood, but that no misunderstanding may exist as to what constitutes the various grades, &c., they have had experts lecturing and demonstrating in a practical manner at various centres to growers and packers what is required, and there is no doubt the

Canadian
Apple Law.

act will be insisted upon and stringently enforced with the best results to the Canadian trade in apples and other fruits. At the Glasgow Exhibition in 1901, a show of cold-stored fresh fruit from 150 fruit-growers throughout the Dominion attracted much attention. The apples, all beautiful specimens, were gathered in October, placed in cold storage in Canada, brought over to this country in the same manner, and kept in Glasgow in cold stores until required for exhibition purposes. The fruit shown at Kelvin-grove was still in sound condition. Thus by means of cold storage fruit can be kept fresh the whole year round, and it is pointed out as an advantage that, while such fruit may be a little dearer than that merely brought over in barrels and warehoused in the ordinary way, the cold-stored article is free from the unsoundness which often, to a large extent, decreases the retailer's profit. In the States the National Apple-Shippers' Association recommended in 1901 uniform packages for apples. A year or two ago there were in cold storage a million and a quarter barrels of apples. The apple succeeds throughout a wider range of territory than any other of the tree fruits grown in the States. In fully two-thirds of the settled parts of the States it is produced more or less successfully. It is estimated that there are in the States

States
Apples. altogether some 200 million apple-trees yielding each year about 176 million bushels of fruit. In years when the crop is bountiful three million bushels are exported, and enough kept in the country to provide two bushels for each inhabitant—the annual *per capita* consumption. New York has first place among the apple-producing states, its annual output now exceeding 24,000,000 bushels; Pennsylvania is second with a scarcely smaller total annual output, and after these leading states there come, as producers of apples, the states of Ohio, Virginia, and Illinois. California is in this respect only fifteenth in order. Formerly Ohio stood first among the apple-producing states, Michigan second, and Kentucky third, but about the beginning of the present century there was heavy tree planting in New York, Pennsylvania, Illinois, Missouri, Kansas, and Oklahoma. The increase in the several states and territories in ten years was 81,641,000 trees. In the like decade the apple crop increased to 82 per cent of all orchard fruits. It may be added that in value of orchard products California leads all the

other states, New York standing second, Pennsylvania third, Ohio fourth, Illinois fifth, and Michigan sixth. These six states, with Indiana, Missouri, Virginia, and New Jersey, raise 69 per cent of the orchard fruit in the United States, measured by value. Michigan stands first in peaches and California first in plums, prunes, pears, grapes, oranges, and lemons. Of all the orchard trees in the United States, 55 per cent are apple-trees. Portugal produces apples of excellent quality and which remain in good condition much later in the season than English apples.

Bananas are grown in many parts of the world, and have come marvellously to the front in British markets in recent years, thanks very largely to the energetic development of the carrying trade. They are now "in season" here all the year round, and are imported in very large quantities from the Canary Isles and Jamaica (latter mainly *via* Bristol). It was at first feared that the subsidized Jamaica trade would injure the Canary trade, but up to 1902 the Canary bananas had well held their own, and their export had been largely increased. Nevertheless the Jamaican export of this popular fruit increased to considerably over a million pounds value in 1902. At one time botanists considered *plantains* and *bananas* to be two distinct species of the genus *Musa*; they are now generally looked upon as merely varieties of one species, *Musa sapientum*. Plantains are referred to by botanists as *Musa sapientum*, var. *Paradisiaca*. The old specific term *Paradisiaca* was applied because of the tradition that the plantain was the forbidden fruit of the garden of Eden—the "apple" which Eve gave to Adam. In India it is customary to speak of both bananas and plantains as plantains; in Zanzibar the custom is just the contrary, both being there called bananas. In the West Indies more distinction is drawn between the two, the banana being eaten raw as a fruit, while the plantain, which is larger, is cooked as a vegetable or pounded into meal. In Zanzibar there are intermediate varieties which are sometimes eaten ripe and sometimes cooked. The fruit of the banana is arranged spirally upon a spike in clusters of double rows, each cluster containing from ten to thirty bananas, according to the variety of the plant and its vigour. The number of clusters upon a bunch also varies, one kind having but two or three while another has ten or fifteen or more. As a rule the bananas in a cluster are

all arranged closely together, and when a cluster opens the "bract" of folded leaves curls up and withers; at first the fruit is curved downwards, while afterwards it takes an upward direction. The residue of unexpanded bracts and buds which hang below the ripening bunch are called "drops". The official journal of Agriculture for Zanzibar, in an account of the banana, enumerates nineteen different varieties, amongst which *Mkono wa tembo* (elephant's trunk), called by the natives *Mkono moja*, deserves the first place as it is the largest and the most highly prized as an article of food by both Arabs and natives. A bunch will sell for 8 or 12 annas in the plantation, and is retailed at half an anna per fruit. The stem of the plant, though tall, is not very thick. Consequently a heavy bunch will cause it to lean over and perhaps fall if not supported. Fruit a foot long, clusters two or three, bracts purple in colour, terminal drop long.

In Jamaica the banana is never allowed to ripen on the plant itself. The several "hands", or clusters, of which the bunch is composed ripen successively, and as the process of ripening advances, the upper hands are much nearer to maturity than the lower hands on the same bunch. But, if the bunch be cut at the right moment—the choice of which is one of the most critical operations of banana-growing—the stalk retains sufficient sustenance and vitality to carry on the process of ripening to its maturity. The bunch is accordingly cut while the fingers are still green, the state of maturity at which it is cut being determined by the time at which the fruit is required for consumption. Thus bananas which are to be consumed on the spot are allowed to ripen much more fully on the plant than those which are to be consumed in the United States, and these again are more fully ripened than those which are to be consumed in England. But in all cases the final ripening takes place after the bunch is severed from the plant. A frozen banana being worthless, the temperature of the ship's hold has to be very carefully regulated when bananas are carried, so that while the atmosphere is kept cool it may not be too cold. From the time the fruit leaves the ship's hold until it appears at table the banana needs proper treatment if it is to develop its full virtues as a fruit and as a food. Although the skin looks tough it is easily bruised and injured, and the fruit so spoiled. Kept in a moderately warm

A BANANA PLANTATION

Amongst the food-supplies of all kinds which now pour into Britain from all parts of the world, affording the British public a range of choice quite unparalleled elsewhere, bananas are now by no means unimportant. In fact few trades have shown in recent years such a remarkable development. This is owing chiefly to wise government aid and intelligent shipping enterprise, but in the distribution of the fruit to the public—the final test of any trade—the grocers have taken a chief part, and there are now comparatively few grocers' shops that do not in the season display the popular banana. In the British Empire's banana supplies Jamaica is a foremost producer. We give a view of a Jamaica plantation at gathering-time.



A JAMAICA BANANA PLANTATION



place, and protected from draughts, the solid green vegetable-like substance gradually changes to a pale golden fruit with delicious flavour and bouquet.

Recipes for Cooking Bananas.—The following are recommended as simple recipes for cooking Jamaica bananas:—Cut about a quarter of an inch from each end, but do not peel the bananas. Lay them in a baking-dish and bake in a hot oven for about fifteen minutes. When done, the skin should burst open like that of a baked apple. Then turn the bananas over, and bake for five minutes on the other side. Serve very hot.

Cooking
Recipes.

Another method is to remove a strip of the skin, cutting off each end as before, and place in a shallow pan with the exposed side up. Mix two table-spoonfuls of sugar, two of melted butter, and two of lemon juice with a pinch of salt, and baste the bananas with this while they are baking for fifteen to twenty minutes till soft. Heat the remainder of the dressing and pour over the bananas. Serve very hot.

Slice ripe bananas lengthways and fry with lard. Eat with meat, or serve with sprinkled sugar. A squeeze of lemon is an improvement.

Peel ripe bananas, dip them, whole or sliced, in batter, and fry until crisp and light brown.

Peel ripe bananas and place in a pie-dish. Sprinkle a little lemon juice and sugar on them, half cover with water; bake for twenty minutes. When cool, serve with custard, cream or milk.

"Angels' Food."—In the United States, where bananas are very largely consumed—long special trains even carrying them thousands of miles across the continent to California, where the fruit does not grow,—a delicious fruit salad is very popular; in South Africa the same wholesome desert dish is called "Angels' Food". Peel six good-sized bananas and cut them into slices (about as thick as a penny) until the slices cover the bottom of a glass dish. Then peel and slice two or three fair-sized oranges, being careful to remove the seeds, and lay the sliced oranges on top of the bananas. Over these sprinkle fine sugar, and follow this with another layer of sliced bananas, and again a layer of oranges and sugar. The dish should be prepared about

five hours before it is consumed, so that the juice of the oranges may permeate the bananas.

In choosing bunches of bananas for sale, it is well to remember that the smaller fruit is often the best flavoured. The
 Choosing
 Bananas. rind should be thin, and without coarse ridges, which usually indicate coarse fruit. If the thick end of the branch is black the fruit will be too quickly ripe; the skin should be green for at any rate part of its length. The fruit is best when just turning yellow. Green bananas, if they have not been spoilt by frost, will ripen in a week if hung in a room where the air is humid and the temperature about 60° or 70°. In America Paterfamilias very often orders a bunch or two of bananas from a shipper, hangs them up in the basement near the family furnace, on which he has placed a vessel of water to keep the air moist, and cuts the fruit off as it ripens. When exposing a bunch for sale, the retailer should trim off the smaller and less attractive-looking "fingers", and offer them separately, leaving the bunch in a condition to show to advantage, so that purchasers may choose for themselves to mutual satisfaction. Banana stands are cheap and handy for displaying bunches of the fruit. They are made of three bamboo poles, about 6 feet high, so arranged that one of the huge bunches can be slung while a basket of fruit is placed below.

Grapes from Almeria in Spain are handled by the British trade from about the end of August to the middle of November; those of Denia and Malaga in August; those of Lisbon
 Grapes. from August to November; and those from the Cape in February and March. The grape trade has been largely influenced of late years by the large increase of home-grown supplies. Formerly the salesman depended on the Dutch Hambros, coming in round baskets, and the Lisbon Sweetwater through the autumn, and through the winter on those coming from Almeria in barrels. The Dutch are seldom seen now, having been superseded by Channel Island and English grapes. On the other hand, the Sweetwater grapes from Lisbon and Almeria come in much larger quantities now than formerly, and many tons also come from Malaga, Denia, and elsewhere, packed in cork-dust; while cool chambers in the mail steamers carry others from South Africa—where splendid grapes grow in the open air—and a few

from Australia. Nevertheless the quantity of home-grown grapes sold to the public has enormously increased. Great quantities are grown under glass, without artificial heat, in Jersey and Guernsey; Worthing also is a great grape-growing centre. Excellent grapes are grown also in Scotland, but now are chiefly sold locally instead of being sent to London as used to be the case.

The grapes chiefly grown in British private gardens are Muscat of Alexandria, Black Hamburgh, Madresfield Court, Gros Colmar, Black Alicante, all of which combine good appearance with fine flavour. The total crop is supposed to reach several millions of pounds. For the choice hot-house English or Scotch grapes high prices are always obtained, but probably the day of high prices for the commoner kinds has gone by now that the transport problem has been pretty well solved. It is probable that the Cape grapes will become very important competitors with the Spanish and other kinds, fruit, both white and black, of splendid shape and fine flavour, being largely grown at the Cape in just the months which are our northern winter, so that they reach the market at an opportune time for disposal. Of the Almeria—which are white grapes—the early varieties sent to Liverpool and London are the “Uva de Casta”, “Castiza” (choice tinted), “Imperiales”, “Rosadas”, &c. “Uva de embarque” reach us chiefly in half-barrels holding about 48 lbs. Hitherto there has been a practice of bringing the later Continental grapes and storing them in the barrels for sale in the off season, but the Cape trade will doubtless interfere much with this as it develops. Another plan for keeping grapes is to pack them in peat-dust in boxes and store in a cool even temperature. If ripe hot-house grapes are cut with a few inches of the wood left, and the bunches are hung up so that the lower end of the shoot is immersed in clear rain-water in which a little charcoal has been placed, it is said they will keep good through the winter, providing care is taken to remove any decaying berries before they contaminate the water. The air should be fresh and dry, but not too dry, and the temperature not below 35° or more than 50°. In 1902 the new Almeria grapes, the first of a crop estimated at 1,500,000 barrels, arrived by steamer in the Thames on August 10.

Next to Almeria grapes in importance at the end of summer

is the **melon** trade. Besides being an excellent fruit the melon is a remarkably cheap one, and it arrives first at a time of year

when the thirsty public can usually appreciate its juiciness

Melons. —July, the season lasting as a rule through August, September, and October. Home-grown may begin as early as March. The melon is the fruit of the *Cucumis melo*, belonging to the natural order Cucurbitaceæ, comprehending the melon, cucumber, and some sorts of gourd. The *Cucumis* is a rough trailing herbaceous plant, having rounded angular leaves and yellow funnel-shaped flowers. Its annual root and rapid growth enable it to be cultivated in the short summers of northern climates, but the flavour of the fruit is much heightened by exposure to a hot sun. The form of the fruit is in general oval, but varies exceedingly in the different varieties, which are very numerous. In some the external surface is smooth, in others netted, in others divided by grooves into segments. The fruit has a delightful odour. The flesh is usually yellow, and in the best sorts has a delicious and sugary taste when ripe. The melon is called the *Musk-melon* in America to distinguish it from the *Water-melon*. The *Water-melon* is the product of the *C. citrullus*, an Eastern plant somewhat resembling that already mentioned, but having leaves deeply divided into lobes. It is smooth, roundish, and has a green rind. It is often $1\frac{1}{2}$ foot in diameter. The flesh is usually reddish, sometimes white, very juicy, and has a sugary taste; it melts in the mouth, and is extremely refreshing. In all warm countries it is cultivated to a great extent; the Cape is the latest producer to export it here. A kind of melon called *Cucumis utilisissimus*, which grows in India, has a fleshy oval fruit, and the seeds contain farinaceous matter blended with a mild oil; these seeds are an article of commerce. The *Musk-melons* comprise the citron, nutmeg, Cantaloup, and pine-apple melons, the latter grown to perfection about Montreal. Of the water-melons, the approved varieties are the Spanish, the Carolina, the orange melon, the apple-seed melon. Cantaloups are so-called from being grown at Cantalupo, near Rome. In these also there are numerous varieties and colours of flesh. Chittas are an Indian kind grown near Lucknow.

Melons that have matured properly on the vine usually turn, on one side, from white to a pale-yellow, and small pimples may

sometimes be observed on the surface. The pale-yellow colour may be produced very nearly by turning the under part of the melon for a day or two to the sun, but the tint is deeper and the pimples are absent if the fruit has been pulled too early. The ripe melon has a rather hard yellow rind, and when pressed the pulp inside, being brittle, may be heard to crack. A dull-brown appearance of a skin that peels readily is another indication of ripeness. The water-melons arrive here chiefly from Spain, France, and the Mediterranean, but are largely grown elsewhere. In the States they are sometimes stored, the stems being left long and the fruit carefully covered up with hay.

Lemons, now always obtainable, arrive from Malaga in September, October, and November; from Messina and Palermo, in Sicily, November to August; from Naples, the Italian capital, in the months from March to October; and from Lemons. Australia from July to September. The fruit of *Citrus limonum*, the lemon-tree, was originally brought from tropical Asia, but is now cultivated very extensively in Southern Europe, especially in Sicily. The tree, which belongs to the order Aurantiaceæ, is congeneric with the orange and citron. It has the stature of a large shrub; the leaves are pointed, oval, twice as long as broad, and their smooth, evergreen appearance gives the tree great beauty, while its flowers and fruit have delightful fragrance. The leaves have scattered glands filled with a volatile oil. The juice and the oil are both valuable articles of commerce. *Lemon juice* is apt to decompose; but this is to some extent prevented Lemon Juice. by excluding air; by heating the juice to 150°, filtering, and keeping in full bottles; or by the addition of a little alcohol. The volatile *Oil of Lemon* is got from the fresh rind either by pressure or by distillation with water, and is of a yellow or greenish colour with a characteristic smell and taste. Lemon-oil forms part of syrup of lemon and tincture of lemon; it is sometimes adulterated with turpentine and cheaper oils, which can usually be detected by the odour or by the alteration of the optical properties of the oil. What is commonly called "salt of lemons" is in reality the same as salt of sorrel, and is a highly poisonous chemical. *Essence of Lemon* is the oil of lemon mixed with rectified spirit, a little carbonate of magnesia being added.

To return to the fruit, the Sicilian lemons are gathered in

October and in November, those under 3 inches girth being left on the trees from the first picking to the second, when the fruit is paler and firmer, but equally good. Other crops are taken, the heaviest being those of November and December, and the last of the season in February; while in March and April fruit produced from the blossoms of the previous August and September may be plucked. The various crops are sorted according to their character, a certain proportion being fit for export, and the rest retained for conversion into essence and juice. Thus, of the November fruit usually about seven-eighths is suitable for shipment, while in February only a fourth may be sufficiently good. Several lines of steamers are constantly engaged carrying lemons from Sicily to the United States, where the "American drinks" draw largely on the lemon supply. Lemons for shipment are picked green and hard, and are sorted out in troughs and on tables in the lemon-storing warehouses, sometimes after being ripened in dry sand, as those ripened on the tree become too thick-skinned and soon rot.

In handling the lemon, it is necessary to take care not to bruise the fruit. They keep best when the air is excluded, each fruit being wrapped in paper and the boxes stored on end, but not too closely together, nor in a close room. One way of keeping them for a few weeks is to wrap each lemon in tissue-paper and immerse it stalk end down in a box of clean dry sand, each fruit separated from its neighbour, and each layer being covered to an inch or more depth in the sand before a second layer is put over it. The sand should be well dried, but cooled again, before the lemons are put in. Another plan is to put the lemons in a cask of cold and pure water and keep them in a cool place, changing the water thrice a week. It is hardly necessary nowadays to expatiate on the dietetic and other virtues of the lemon; suffice it that the grocer will find the fruit well worth his attention in every way.

From the *New Popular Encyclopedia* of the Gresham Publishing Company we transcribe the following recipe for *Lemonade*. *Lemonade*, which may perhaps assist the grocer in pushing his lemons if he presents it to his customers:—

Two sliced lemons, $2\frac{1}{2}$ ozs. of sugar, boiling water $1\frac{1}{2}$ pint; mix, cover up the vessel, let it stand, with occasional stirring, till cold, then pour off the clear liquid

through a piece of muslin or hair sieve. Prepared in this simple way it is a very grateful beverage in warm weather or to feverish patients. The taste is more agreeable if the sugar is rubbed with the peel of the lemon, so as to imbibe the oil contained therein; but the lemonade is thus rendered stimulant rather than cooling, and many persons suffer from headache in consequence. Aerated bottled lemonade as made by the best makers is prepared by putting $1\frac{1}{2}$ fluid oz. of lemon syrup into each bottle, which is then filled up with aerated water at a bottling-machine.

The **Orange** is another extremely valuable fruit of which the modern grocer dispenses enormous quantities. The bitter orange, lemon, and citron have been longer known in Europe than the sweet orange, whose native country is supposed to be Oranges. China or the north of India; but the tree is now cultivated in almost every country where it finds a suitable climate. In Spain, Portugal, Italy, and Sicily it is much cultivated, also in Syria, North Africa, Turkey, China, India, South America, the Azores, the West Indies, Florida, California, New South Wales, South Africa, &c. Most of ours have hitherto come from Spain, but Mr. Froude writes that the worst orange he ever tasted in Jamaica was better than the best he ever ate elsewhere! Lisbon oranges have also lately acquired a good name amongst travellers for their juicy sweetness. The Portuguese have paid considerable attention to the China type of orange. But nowadays we are hardly ever at a loss for good eating oranges. The seasons specially recognized on the wholesale markets are: Almeria, November; Australian, July, August, and September; Brazilian, August and September; Jaffa, October to February; Palermo and Messina, October and February; Naples, May to August; Florida, September and October; Valencia and Denia, November to July; Seville and Palermo "sours", January to March; Murcia, July and August.

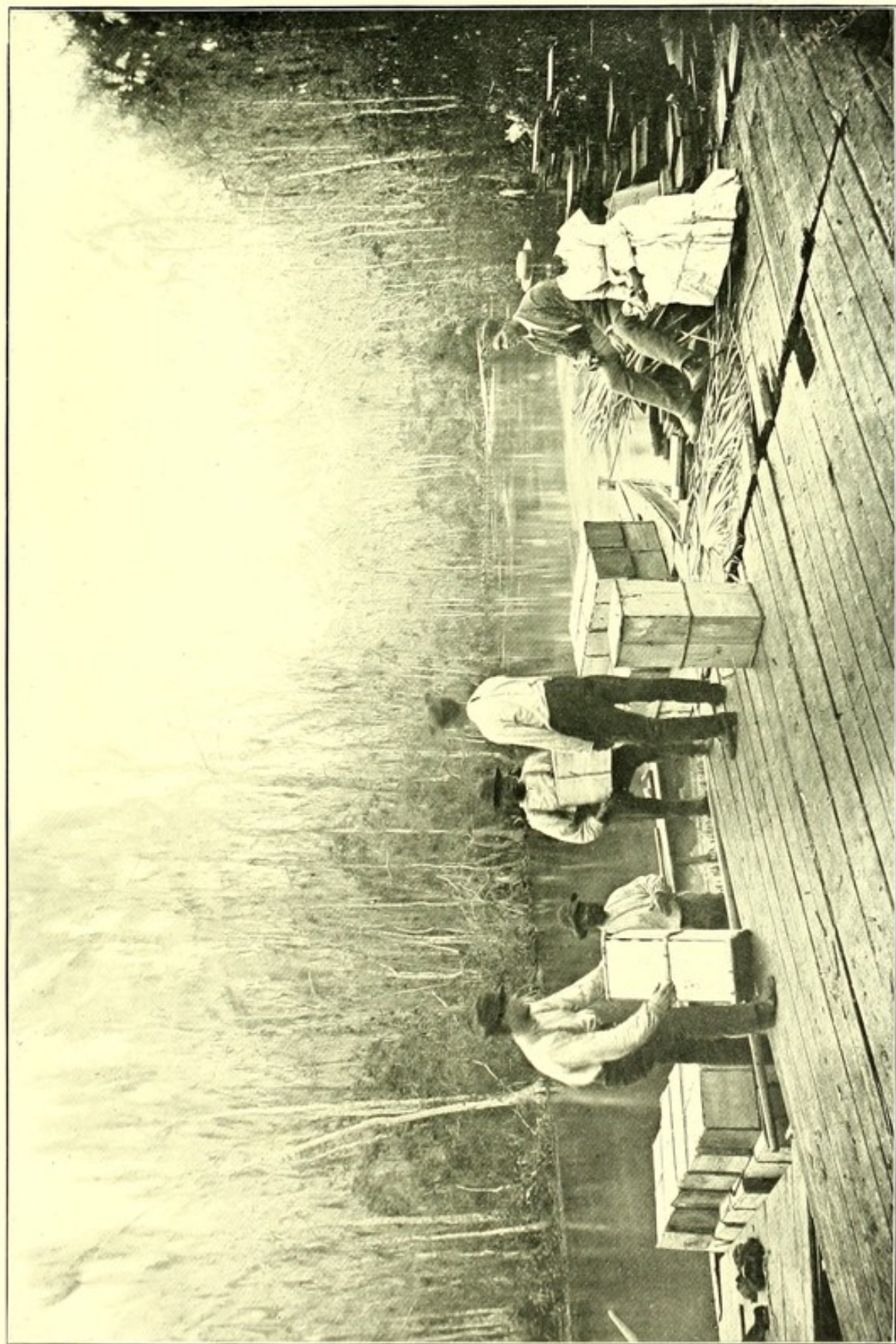
There are many varieties of the sweet orange, the most remarkable in some respects being the China orange, the blood-red or Maltese, and the Majorca or seedless. The Varieties
of Oranges. bitter or Seville orange appears to have been cultivated by the Moors of Spain, apparently for medicinal purposes; in Great Britain it is chiefly used for marmalade, whilst the rind is employed as a tonic. The Tangerine orange is rather larger than a walnut, its rind is highly perfumed, and the pulp has an agreeable flavour. The Bergamot orange yields the oil of that name,

esteemed in perfumery. An orange a trifle larger than the Tangerine, and rather flatter and darker, but otherwise much resembling it, is the Mandarin, a native of China, sweet in taste and delightfully perfumed, and having a thin tender rind easily peeled. This orange is now grown a good deal in Malta, Spain, Algeria, and Italy; and as the "naartje" it is familiar in South Africa—where, by the way, the orange is called by the Boers "lammoen", and the lemon "suur-lammoen". Mandarins arrive in December in small boxes of 25, 50, or 72, each fruit usually wrapped in tinfoil or fancy paper. The Satsuma or Japanese orange is similar to the Tangerine and Mandarin, but rather larger. The "Suykan", a Japanese sweet orange, has a very pleasant flavour. Another Japanese orange is the Comquat, a very small fruit from a dwarf tree. In Bahia we get the Umbigo, a large, sweet, seedless orange; and in Brazil the Siletto, a very sweet and delicately flavoured seedless orange. Neapolitan or Sorrento oranges, which reach London in early spring, are rather thick-skinned and rough, but of fair size, sweet, and good flavour.

Kinds of Oranges. Indian oranges include the Suntara, a semi-wild orange of the Mandarin type which grows in Calcutta, Sylhet, Delhi, and elsewhere; also the Khatta, a sour or bitter orange. The "Sours", besides the Seville orange already mentioned, also come from Denia in Spain, the Canary Isles, Portugal, and elsewhere. Another variety are the Egg oranges, so-called from their shape, and grown in Malta, Jaffa, Zanzibar (small), &c. Florida and Mexico are large orange-growers. Jaffa is able to export yearly some half-million boxes of oranges, and the cultivation of the tree is on the increase, although the gardens have to be artificially irrigated. A much-prized oval orange is grown on the sunny slopes of Mount Etna, in Sicily, and has helped to give the Catania orange the reputation it enjoys in America. The Navel orange comes from Brazil, and seedless Navels are now grown in immense quantities in California, where they were introduced from Brazil. The California oranges are usually large, but not equal in flavour to the China oranges grown in Spain and Portugal. Some years ago the Californian grower was troubled with "scale", a pest which ruined many crops. The United States Government was asked to import "ladybirds" from Australia to combat this pest, but refused. Later on, private

LOADING ORANGES IN FLORIDA

The cultivation of the sweet orange has spread from West and Upper India (where it still grows wild) and China to many parts of the world, Florida being one of the countries whose orange-groves are most famous. The West Indies are found particularly favourable, being free from the cold snaps which visit Florida and frequently kill the trees. The best soil is said to be one free from sand, well drained, and fairly deep; there must be some shelter from the wind, and sun is of vital importance. The tree is an ever-green, having oblong pointed leaves with toothed edges; the leaf-stalks have "wings"; the bark is greenish-brown and the blossom white. In gathering the fruit great care is used to avoid bruises; they are sometimes hand-picked, or cut from the tree with a piece of stalk attached; the gathering takes place on a dry day when the fruit is still unripe. Rolled in paper, the fruit is packed in ventilated boxes, being well pressed together in the packing in order to avoid the oranges becoming loose enough to shake and bruise when the slight shrinkage takes place on the voyage.



LOADING ORANGES ON THE OCKLAWAHA RIVER, FLORIDA, U.S.A.



enterprise introduced the ladybirds, and according to Dr. MacDougall, the "scale" insect was wiped out in about eighteen months. In California from four to six hundred oranges per tree is an average crop; in the West Indies (where the tree is propagated from seed) the average is three to four thousand per tree; and in Dominica a single tree will sometimes yield eight thousand. Australia is among the later sources of excellent oranges, and we also receive the first-class orange of Jamaica, of which a hundred million are sent annually to the United States.

In gathering and handling oranges great care is used to avoid bruises. On a dry day, when they are still unripe, the oranges are hand-picked from the tree, being cut off with a piece of stalk attached. They are then separately rolled in tissue-
Handling Oranges.
 paper for preserving them from harm, and are tightly packed in ventilated boxes, considerable pressure being used because, as there is a slight shrinkage during the subsequent voyage, it is necessary to avoid the possibility of the fruit becoming so loose as to shake and bruise. This fact should be noted by assistants handling oranges. Note also that oranges have the power of absorbing odours, so that a blood-orange (which has this property in an especial degree) may acquire a most unpleasant oniony taste from being packed close to onions for a few days. A thin and smooth skin is a good sign in an orange, though sometimes a skin too clean and polished may indicate that some dishonest costermonger has boiled it to improve the appearance. In buying oranges a merchant not infrequently judges them by taking one in his hand and squeezing it until it bursts, when the juiciness decides. Oranges are customarily packed in two sizes—714 and 420 to the case. Thus the 714's show, at 10s. a case, 71 for a shilling, or 2d. a dozen; at 20s. a case, 36 for a shilling, or 4d. a dozen; while the 420's, at 10s. a case, show 42 for a shilling, or 3½d. a dozen; and so on. From "ordinary" up to "extra choice large selected" as many as thirteen gradations are recognized in classifying oranges and lemons on the London market.

Limes, which are thought by some to be preferable to lemons, are very perishable. They should be kept in a cool, dry place, and covered with sand. They are said to be invaluable for rheumatism, colds, and skin diseases. The
Limes and Citrons.
 lime is rather more juicy and more acridly acid than the

lemon, very much smaller, rounder in shape, and having a smoother rind. The *Citrus limetta* or lime is grown for its fruit and the fruit for its juice in Montserrat, Dominica, Jamaica, and Trinidad. The juice is pressed out in mills or presses, a barrel of limes yielding about eight gallons. When the juice has been cleared of impurities, if it is to be kept long, fermentation is prevented by adding to every fifty gallons of juice half an ounce of salicylic acid. *Concentrated Lime-juice* is prepared by evaporating the clarified juice in open copper pans to one-tenth of its bulk; in this state each gallon contains a hundred ounces of citric acid. As iron turns the acid black and spoils the flavour, no iron vessel should be used for lime-juice. **Citrons** (*Citrus medicus*) are a fruit somewhat resembling a lemon in colour, taste, and smell, and having a thick, spongy, and very fragrant rind. Many varieties are grown in Italy and France, but the largest are those of Corsica, which are chiefly used for making candied peel. In Naples and Sicily large quantities of citrons are grown, and citron-juice is an important Messina export. The British Consul at Ajaccio writes:—"I attribute the size, aroma, and general superiority of the Corsican citron (or Cedratur), which always commands a higher price in the market than that produced in other countries, in a great degree to the soil of Corsica, which is not only extremely rich in ferruginous qualities but is also strongly impregnated with the various salts and chemicals necessary for the production of the numerous aromatic plants with which the island abounds". Some three thousand tons of Corsican citrons are annually exported. The greatest market for citrons, however, is Trieste, where it is estimated five thousand tons are often collected for sale in a single year. For centuries the Jews of various countries have been accustomed to assemble at Trieste in August to procure the "Citron of the Law" for use in their religious ceremonies in the Feast of Tabernacles. This kind of citron is non-edible and is the unripe fruit of the ungrafted tree. The fruit must be unblemished, with the calyx uninjured, and when selected for Jewish use care is taken to preserve the calyx by wrapping each fruit separately in soft tow. The fruits are then packed, 120 in a case, for distribution, not a few annually coming to England.

Pine-Apples, thanks to the Azores, have of late years become plentiful and cheap nearly all the year round. From St. Michael's they arrive each month in great quanti-

ties, sometimes 20,000 at a time. Growers in Florida and other countries are also looking to the British market. The name comes from the resemblance of the fruit to the cone of the pine. Evelyn in his *Diary* mentions the pine-apple for the first time in England as having been eaten at the banquet given to the French Ambassador in 1668. "Standing by His Majesty at dinner in the Presence", says he, "there was of that rare fruit called the King-Pine, growing in Barbados and the West Indies, the first of them I had ever seen. His Majesty having cut it up, was pleased to give me a piece off his own plate to taste of." The pine-apple is now grown in the West Indies, Madeira, the Canary Isles, Zanzibar, Natal, Singapore, and elsewhere in most warm countries. In the Bahamas they are grown in fields in large quantities. The fruit is cut before becoming ripe, care being taken to avoid bruises. It is then carefully wrapped in paper or in the tissue sheath of the maize, and is packed in ventilated, partitioned boxes, three or four pines in each partition, or, as at Madeira and in the Canaries, each pine in a separate compartment. In eating pine-apples it is recommended that first of all the fruit should be properly pared, the eyes being all cut out so that the sharp little spears found therein may be removed; when pared, slice the pine vertically all round until the core is reached.

Pears we receive from France in September, October, and November, and this also has become a large trade, while Canada, California, and other States, as well as Australia Pears. and Cape Colony, are contributors. Of English pears we have such fine-flavoured sorts as Jargonelles, Williams, Duchesse, Marie Louise, and others. France sends Doyennes, Beurres, Josephine de Malines, and others; America the Bartlett, Seckel, Kieffer, and so on. Pears should be picked when mature and ripened indoors; they should be stored in air a little warmer and drier than that for apples (which do best in cold so long as they do not freeze), and should not be placed near strong-smelling goods, or they will acquire a bad flavour.

Pomegranates come in at the end of September, chiefly from Spain and Portugal. The *Punica granatum*, Carthaginian apple of the Romans, *rimmôn* of Scripture, is Pomegranates. in its wild state a dense spiny shrub, 8 or 10 feet high, but under cultivation attains double this size. It has smooth leaves and large,

red flowers. The fruit is about the size of a large apple, has a thick, coriaceous rind crowned with the teeth of the calyx, and is filled with a multitude of small, red seeds, and a more or less acid, slightly astringent pulp. For its fruit the pomegranate is cultivated throughout a great part of southern Europe, and for its flowers is a favourite even in climates like ours, where the fruit will not grow to perfection. In warm climates the fruit sometimes attains a great size, although there is a variety used for hedges in the West Indies and Guiana the flowers and fruit of which are very small. Ripe and fresh, the fruit has a nice yellow colour, sun-tinged on one side with rose. The edible pulp inside is in the form of reddish globules like currants, which have a sweetish, sub-acid flavour. Mixed with water and sugar, or honey, these make a pleasant and cooling beverage. The South American aguardiente is made from them, and in Persia a kind of wine. At the Feast of Tabernacles Jews consume the pomegranate as a religious observance.

The **Grape-Fruit**, or **Pomelo**, which is very largely consumed in the United States, belongs to the orange tribe, as do also the **Grape-Fruit.** *Shaddock* and the so-called *Forbidden Fruit*. Dr. Morris, in his official report on the West Indies, writes:—"The grape-fruit is a member of the orange tribe that has lately come into great favour in the United States. It is a fruit allied to the shaddock (*Citrus decumana*), but smaller and with a finer flavour. It is regarded as very wholesome and refreshing, and possessing valuable tonic properties. Fortunately trees yielding this fruit were already plentiful in Jamaica, and the island was at once able to meet the demand. It is probable that it may eventually be more profitable to grow the grape-fruit than the orange." The shaddock and grape-fruit both resemble in appearance very large, smooth-skinned oranges though rather paler in colour. The girth is 6 to 9 inches and the weight of the shaddock may be as much as 15 lbs. Inside, the fruit contains twelve or more cells with red and white pulp and egg-shaped seeds, the pulp sweet and sub-acid, useful for preserve-making. The fruit should be cut in half across (not downwards) and the pips and core carefully removed. Then add a little port, sherry, or spirit (rum is preferred by some), and cane caster sugar or honey to taste, and eat with a spoon. "Another excellent way is to remove the fibre, cut the pulp in cubes, drench with sherry, and add a spoonful of curaçao and some

powdered sugar." The reason of the fruit becoming so popular in America is that it is credited with being the best medicine under the sun for biliousness and malarial fever. The juice is said to contain phosphoric acid. The best time to take the fruit is before breakfast. An enthusiastic Colonist writes: "Let medical men order patients for whom they would otherwise order quinine and iron, and all dyspeptic, bilious, and nervous patients, half of a grape-fruit in the morning and another at mid-day, and note the effect". The fruit should be eaten as a tonic before meals. In Jamaica the grape-fruit is not usually eaten before January; from then through February and March it has a delightful sweet acid flavour. In America it is on the markets from Jamaica as early as September in some seasons, but is then bitter. None the less it is in great demand, and may be so ere long in Great Britain.

The *East Indian Papaya*, botanically of the passion-flower family, is a melon-like fruit grown upon a tree which flourishes all over tropical India. Although called the *Paw-paw* in the States it is different from that fruit, which is of the A very Curious Fruit. custard-apple family. From an interesting report by the United States consul at Bombay we take the following:—

"The yellowish-white flowers are diœcious, having the pistils of the flower on one tree and the stamens on another. . . . One is called the female and the other the male tree. Perhaps in all the vegetable kingdom there is no other plant or tree that so well illustrates the sexual system of plant life. In order that the female tree may bear and ripen its fruit, repeated experiments have shown the necessity of the male tree being so situated as to ensure the influence of its flowers on those of the female and render them fertile. The fruit when ripe attains the size of a small melon, which it somewhat resembles. . . . It is eaten by all classes and is considered wholesome. In the West Indies it is sometimes boiled and eaten as a vegetable. In India, when green, it is cooked by the natives in their curries and is also pickled. It is usually, however, eaten raw, when ripe, with salt, and is ranked among the finest of Eastern fruits."

Special attention is drawn to the remarkable chemical and medicinal qualities of the *papaya*. The fruit secretes a creamy juice containing a principle called "papain", which acts on nitrogenous substances like the human digestive principle pepsin,

curdling milk and dissolving albumen. The juice also contains fibrine, a principle otherwise found only in the animal kingdom; in fact it has been compared to blood without the colour. "Tough or fresh meat of any kind dipped in water containing a few drops of the juice, or boiled in water impregnated with the juice, will", says the consul, "become in a few minutes quite tender. . . . I have repeatedly seen my native Hindu cook, on returning from market, roll the fresh meat or recently killed fowl in a papaya leaf, where it would remain for a few hours before cooking, thus rendering the meat perfectly tender. . . . The green fruit cooked as a vegetable, and the ripe fruit eaten as a dessert, seem to have about the same effect as a good digestive and are most effective in cases of dyspepsia and habitual constipation." The papaya-tree grows luxuriantly in Southern Florida.

The Tamarind is a typical fruit having a juicy pulp and seeds in flat pods about 4 inches long; those from East India, being largest and sweetest, are considered the best.

The Olive which may be mentioned here for the sake of convenience, is the unripe fruit of the evergreen shrub *Olea* *Europæa*, very largely cultivated since the earliest times in Italy, Spain, Greece, France, and Tunis; also now grown in South and Central America, California, and elsewhere. Eating-olives, called "Queen's", are larger green olives grown about Cadiz and gathered during September and October; many are sent to the United States. A smaller and coarser fruit, called Manzanillas, are gathered later and made into oil. The best varieties reach England from Marseilles, Genoa, and Tunis. In the pickling process the olive is gathered young, soaked in lime-water or other strong lye, and then allowed to stand for a week in water which must be clean and repeatedly changed. They are then pickled in brine, seasoned with spices, and sealed up in glass bottles or small barrels. The olive varies in shape according to its kind, being sometimes globular and sometimes oval. The size and colour also vary; but as commonly seen in this country it is much like a small plum, dark-green or violet in colour. Black olives are exported from Greece. Californian olives are "Picholine", a small green fruit the size of a damson, and "Mission", which is larger but not so highly esteemed.

Peaches are very largely grown in the warmer countries,

not so much in Great Britain except under glass. From the Montreuil district in France they are sent about the end of July to all parts of Europe. Enormous quantities ^{Peaches.} are grown in California and the southern parts of Canada; those which are canned are mentioned in another section. "Free-stones" and "cling-stones" are two classes of the fruit; "loose-pits" and "tight-pits" are their names in South Africa. As these names indicate, the stone is free and loose in one kind and tight in the other. American peaches are marketed fresh in crates and boxes, and peaches from Canada and South Africa have been successfully sent here in refrigerated chambers, but have not hitherto been much handled by grocers.

Persimmons are a plum-like fruit grown in various parts of America, also in Japan, China, India, and elsewhere; ^{Persimmons and others.} very sweet and agreeable in flavour when ripe, and good-keeping fruit if in a dry and cool place.

Three of the best South African fruits are loquats, Cape gooseberries, and guavas, the first and last well-known also elsewhere. The *loquat* is a very juicy refreshing fruit the size of a large walnut; the *guava*, which grows wild in the West Indies and Central America, is a fruit of diverse forms, seedy, sweet, and aromatic, much used for jelly and jam; the *Cape gooseberry* is a fruit resembling a cherry in an envelope, and has a most delicious flavour either fresh, candied, or as jam.

Soft Fruits include in the trade classification strawberries, raspberries, gooseberries, red, black, and white currants, rhubarb, &c. These are not usually handled by the grocer, ^{Soft Fruit.} although something might be said for *strawberries*, than which, in classic phrase, "God never made a better berry". For flavour no strawberries compare in this country with the home-grown. Large quantities are grown in Kent, Cambridgeshire, Hampshire, Cheshire, Aberdeenshire, and other counties; they should be packed in punnets. "Paxton", "British Queen", "President", are amongst the best-known British kinds. A great many strawberries are sent here from France; from the Finistère district they arrive in May.

Amongst **Nuts** the common hazel-nut is supposed to be the only kind indigenous to this country. The filbert was cultivated by the Romans and brought here, while the sweet chestnut is a

native of Thessaly. The *Barcelona* variety of hazel-nut, from Spain, is carefully dried in kilns; a bag weighs about 128 lbs. *Coco-nuts*, also spelt coker-nuts, to distinguish them from the cacao-nuts used for drinking-cocoa, are imported with the husk on from the West Indies, Ceylon, and Africa, and from Costa Rica with the husk nearly all removed. The Trinidad are accounted sweetest in flavour. At the costermongers' great Whitsuntide sale of coco-nuts the nuts are customarily classed as large milky, middles, smalls, milky growers, and chats, the last-named being the smallest and thinnest. *Walnuts*, before being shipped from southern France, are usually exposed to the fumes of burning sulphur to clean the shell and preserve the kernel. Grenobles (especially the *noix bijoux*) are ordinarily of best quality and Bordeaux the poorest. Walnuts are largely exported from Naples and Sorrento in Italy at about Christmas-time. In England the nuts are usually gathered in September. Until the end of January the nuts are considered "new". After removal of the husks the nuts are usually spread in an airy room to dry; others are "kiln-dried". Shelled walnuts, dried, are sold to some extent. Nuts may be kept fresh for some months by packing in a barrel in layers of sand or charcoal dust, and storing in a cool place. The times of arrival of imported nuts are: *Barcelonas*, early in November; *Brazils*, May to August; *Spanish*, October to February; *Turkish*, October, November, and December; *Kentish cobs*, August, October, and November; *chestnuts*, October, November, December; *shell almonds*, throughout the year; *walnuts*, French and Italian, October to January.

Cashew Nuts, described in Jamaica as "incomparably the best of all nuts in flavour", require to be roasted and peeled, and it is the kernel which is eaten. When already prepared they should be toasted before eating.

Tomatoes are now a great import trade. The seasons of arrival are: *Canary Island tomatoes*, December to February; *Valencia*, July; *Lisbon*, August. About one-half of the year's total arrives in June, July, and August, many early ones coming from the Channel Islands. Tomatoes in this country are grown largely in vineries and cucumber-houses, as well as in houses specially built; and two or three crops can be

gathered in a year. In the Channel Islands potatoes grown under glass are lifted in April and May to secure the early prices; and as fast as the potatoes are taken out of the ground the tomatoes are put in.

Onions arrive from Egypt from April to the end of June; Lisbon, May to July; Valencia, July to February; Italy, December to February. The Egyptians are firm, medium-sized, but not good keepers, though shipped before Onions. maturity. It has been observed that the onions of the warmer countries, such as Spain and Italy, are larger and not so strong in flavour as those of the colder countries farther north. Warwickshire and Bedfordshire are the English counties most famous for onions. Among the whites are Banbury Improved, White Globe, White Italian, &c.; and of brown skins the Deptford, Brown Globe, Bedfordshire Champion may be named. Red and white Dutch onions, small and suitable for pickling, come in between August and Christmas. Symmetry, small necks, fine flesh, and plumpness are the points of onions. As they are liable to putrefy they should be kept in a cold dry place and turned over occasionally, care being taken to avoid bruising them, and any already "going" being at once removed. They usually keep well hung up.

Potatoes are due from the Canary Islands in February, from Malta in March and April, and from Jersey in May. French, Scotch, and Irish are all renowned, and amongst English varieties the wonderfully prolific "Northern Star" was Potatoes. one of the sensations of 1903. German reds come over in October. Potatoes should not be exposed to the sun; on the contrary, they should be kept as much as possible out of the light. A French plan for keeping them is to place them for twelve hours in a barrel containing water to which sulphuric acid has been added in the proportion of one or two parts of acid to a hundred of water. The potatoes are then dried carefully and stored away in a cool, dry, dark place. Americans sometimes plunge potatoes in a tub of boiling water to prevent sprouting—but this does not appear altogether commendable. The ordinary way of keeping potatoes is to lay them on a dry floor and occasionally turn them over.

A member of the Barbados Parliament writes: "In Barbados

great success has been achieved in the cultivation of sweet-potatoes and *yams* of the very best quality, and an endeavour is now being made to introduce these into this country. The sweet-potato is a cheap and palatable vegetable, but a good yam is a positive luxury. During a long residence in London I imported several barrels every year for my own use, and out of the numerous guests who tasted them at our table there was not one who did not highly appreciate them. I may add that here the flavour is even more delicious than in the West Indies, as butter, which is a vital ingredient in a well-cooked yam, is so much better."

Mushrooms of various species are artificially grown, in France in the abandoned sandstone quarries around Bordeaux, and in

Mushrooms. Edinburgh notably in a disused railway-tunnel. The Edinburgh tunnel beds, each some 10 feet long by about 3 feet wide—being broader at the base than at the top—are placed in rows along one side of the tunnel, and bear no small resemblance to gigantic coffins, or to the top of a newly-made grave; they are shaped to a mathematical nicety by being built up within a wooden mould, which is removed as each is completed. The body of the bed is composed of the finest stable manure, from which the straw has been shaken out. In nothing but stable manure will the mushroom thrive, while the slightest contribution from a pigsty will spoil a whole bed. When the temperature of the bed of manure has fallen to about 80° the mushroom spawn is planted in the proportion of a bushel and a half to each bed, and the whole is covered with 2 inches of fine soil, which is then beaten hard; for, though the mushroom will grow and mature more speedily if the soil is left loose, experience has shown that the crop is less strong and lasting than in a firmly-compressed bed. The grower insists on virgin soil that has never known spade or plough. In from three to six weeks after the sowing of the spawn the mushroom begins to crop, and continues to do so for three months, after which time the bed rapidly deteriorates in productive value, and is sold to farmers for field manure. In the Bordeaux quarries men usually of short stature are engaged in preparing the beds, planting the seed, and gathering the mushrooms in the long tunnels, which are only from 4 to 5 feet in height. These beds are long mounds, built in arch shape,

composed of layers of a sandy variety of earth, and manure. The tunnels below the surface of the earth are naturally damp, and the atmosphere of a peculiar character suitable to the growth and propagation of the mushroom. After a bed has been built and the seed planted it is some time before the mushrooms begin to appear; when they do, each morning men travel from one end of the bed to the other collecting all the heads which have appeared. After a bed has yielded as many as can be expected, it is dug up and fixed with new manure again, and a fresh supply of seed is planted. Mushrooms are grown all the year round. Baskets containing about sixty pounds of ungraded mushrooms, just as they are picked from the bed, are shipped from the country into the Bordeaux or other market. They are then taken by the packers into their factories and strewn out on a table surrounded by women styled "assorters". They take the mushrooms at the table and cut off that portion of the stem which cannot be used, and separate them into baskets according to their grade. The various grades are as follows:—Sur Extra, Extra, First Choice, Choice, Hotel. The Sur Extras are quite small, perfectly uniform, unblemished buttons, closely trimmed; that is, the stems entirely removed. The extras are practically the same quality, but a larger button, not so carefully trimmed. The First Choice are Extra mushrooms with part of the stem left on. The Choice are large, irregular buttons which cannot be put into First Choice or Extras. As imported, French mushrooms are usually graded firsts, seconds, and ordinary. The edible mushroom is white or brownish, with gills of salmon-pink, brown, or almost black; flesh compact and brittle; stalks thick and filled; skin peels easily; juice watery; odour agreeable; the mushroom does not change colour when cut; and the taste must not be bitter, astringent, salty, or sour. Avoid fungi in the button stage, those in which the flesh has begun to decay, those with white gills, and those with milky juice.

Vegetables are imported from abroad to the extent of some six million pounds worth a year, and, measured by their value, more than two-thirds of these are fresh. *Potatoes, onions, and tomatoes* are the principal varieties. *Dried vegetables*, consisting largely of *peas* and *beans*, with smaller quantities of *vetches* and *lentils*, are also imported to a value of considerably over a million

sterling. *Preserved vegetables* are much less extensively purchased. Of our *imported potatoes* (about 450,000 tons a year) the chief sources of supply are France, the Channel Islands, Belgium, and Germany. France leads with more than a quarter of the whole, closely followed by Germany. Belgium and the Channel Islands come next with similar amounts, and the most important of the other sources of supply are the Netherlands, Portugal, the Canary Islands, and Denmark, although we also get a few from Spain, Algeria, Malta, and Norway. *Onions* we obtain from Spain, Egypt, and the Netherlands chiefly, Spain sending more than two-fifths of the whole. Other sources are France, Belgium, Portugal, Germany, Malta and Gozo, Italy, the Canaries, besides some intermittent sources.

The chief *potato*-growing counties of *England* are Lincoln (71,000 acres), York (54,000 acres), Lancaster (44,000 acres), Cambridge, and Chester. The only others having more than 10,000 acres devoted to potatoes are Norfolk, Devon, Kent, and Stafford, although the crop figures in every shire to some extent. The *Scottish* potato-growing counties are firstly, Fife (15,000 acres), Perth (13,000), Forfar (12,000 acres), Ayr, Aberdeen, Haddington, Ross, Inverness, and Edinburgh, all over 5000 acres; while below come Argyll, Lanark, Dumfries, Dumbarton, &c. *Ireland* has a larger acreage under potatoes than has the whole of Great Britain. Nearly 8000 acres are devoted to potatoes in Jersey, and about 2500 acres in the Isle of Man. As the Channel Island potatoes are early and are sent into the British market before the general supply becomes available, they bring an exceptionally high price; so also with the tomatoes received from Jersey and Guernsey. Algeria is a growing source of supply for new potatoes, but the supply goes mainly to France.

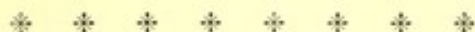
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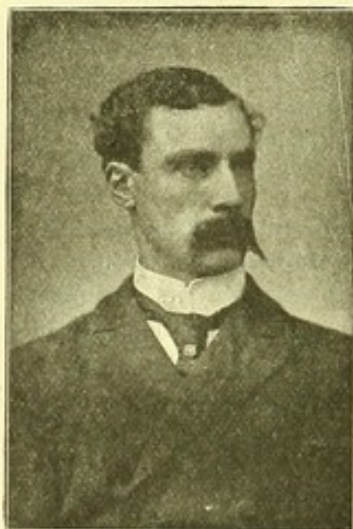
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The Natural History of Animals:

The Animal Life of the World in its various Aspects and Relations. By J. R. AINSWORTH DAVIS, M.A., of Trinity College, Cambridge, and of University College, Aberystwyth. Profusely illustrated with full-page colour and black-and-white plates, and engravings in the text, by eminent animal artists. In 8 half-volumes, cl. extra; also in 4 volumes, Roxburgh binding.

While the sum of human knowledge is gigantic now as compared with what it was a hundred years ago, in the department of Natural History the books upon which the great majority of us must depend have undergone practically no change. The general Natural History still follows the lines adopted by Goldsmith in his famous and delightful *Earth and Animated Nature*. That is to say, they are little more than classified catalogues of animals, taking up in succession the various groups and individuals, and describing them one after another, each as standing by itself. This is not what the intelligent reader of the present day requires. He must be put in a position to take a comprehensive grasp of the subject; he demands a competent guide, not a directory, however accurate.

It is with this end in view that THE NATURAL HISTORY OF ANIMALS has been compiled. It treats this great subject on essentially modern lines, giving an accurate and vivid account of the habits, relationships, mutual interdependence, adaptation to environment, &c., of the living animals of the world.

It is needless to say that the production of such a work demanded a man who has devoted his life to the study of biology and zoology, and who at the same time is a gifted writer and expounder. This rare combination has been found in the person of Prof. J. R. AINSWORTH DAVIS, M.A., of Trinity College, Cambridge, and of University College, Aberystwyth, the author of the present work. Prof. DAVIS is well known to naturalists as an ardent worker in Natural History, particularly in the field of marine zoology. He is a very distinguished graduate of Trinity College, Cambridge, the chief scientific school in Britain, perhaps in the world, and has done a great deal of literary work, both scientific and in other directions.

Briefly, the object of Prof. Davis's work is to give in a readable form and in non-technical language a general survey of the whole animal world from the stand-point of modern science—and the work may fairly claim to be a **Natural History on a new plan**, the first comprehensive work in English of its own special kind. Formerly Natural History had much the character of a miscellaneous aggregate of disconnected facts, but hardly any fact or feature connected with any animal can now be considered as isolated from others; and animals as a whole must be looked upon as interrelated in the most surprising manner both with one another and with their surroundings.

Every household library should contain a Bible, a Dictionary, an Encyclopedia, and a work on Natural History. This is the "irreducible minimum"; other books we may have, these we must. For THE NATURAL HISTORY OF ANIMALS it may fairly be claimed that it has a better title than any other work to become the **Natural History for the Household**. It is a work in which the adult reader will find a never-failing mine of information, while the younger members of the family will delight in its wealth of illustration, and its store of interesting and suggestive anecdote.

To teachers THE NATURAL HISTORY OF ANIMALS may be regarded as indispensable. More than usual attention has of late been directed to the important subject of **Nature-study**; and in this respect the appearance of Prof. Davis's work could scarcely have been more fitly timed. In the domain of Natural History it is pre-eminently the book for the purpose. Its clear and orderly arrangement of facts, its masterly grasp of general principles, its comprehensiveness of scope and simplicity of style, combined with the most absolute scientific accuracy, render this work an invaluable book of reference for those who aspire to teach Nature-study on up-to-date principles.

The Illustrations, as befits a work of such importance, are on the most lavish scale. A large number are in colour, reproductions, by the latest processes of colour engraving, of exquisite pictures by the most eminent animal draughtsmen. In illustrating the work talent has been sought wherever it was to be found; and the list of artists is representative of several nationalities. A large number of the designs are the work of Mr. A. FAIRFAX MUCKLEY, who is probably unsurpassed in the capacity to depict living creatures with absolute fidelity to detail without sacrificing the general artistic effect. FRIEDRICH SPECHT, one of the most eminent German animal painters of the past century, is represented in THE NATURAL HISTORY OF ANIMALS by many of his best designs in colour and black-and-white. W. KUHNERT, another German artist whose work is universally admired; and M. A. KOEKKOEK, the talented Dutch painter, are also among those who have assisted in the embellishment of the work. An important feature is the series of diagrammatic designs showing the structure of certain typical animals, specially drawn under the direction of Prof. Davis.

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The Modern Carpenter, Joiner, and Cabinet-Maker:

A Complete Guide to Current Practice. Prepared under the editorship of G. LISTER SUTCLIFFE, Architect, Associate of the Royal Institute of British Architects, Member of the Sanitary Institute, editor and joint-author of "Modern House-Construction", author of "Concrete: Its Nature and Uses", &c. With contributions from many specialists. Illustrated by a series of about 100 separately-printed plates and 1000 figures in the text. In 8 divisional volumes, super-royal quarto, handsomely bound in cloth, with cover design by Mr. TALWIN MORRIS; also in 2 volumes, Roxburgh binding. In complete sets only.

In preparing THE MODERN CARPENTER the editor has had the great advantage of working upon the basis of Newlands's *Carpenter and Joiner's Assistant*, which for nearly half a century has been accepted as a **standard authority** on the subjects of which it treats, and for many years has been recommended by the Royal Institute of British Architects as a **text-book** for the examination of that society. And yet in the present work it has been possible to preserve only a very small part of Newlands's treatise, invaluable though this has been to two generations of craftsmen. While the fundamental features of arrangement and method which distinguish this famous work have been retained, the matter has had to be **entirely rewritten**, and many new sections have been added, on subjects not touched upon in the older work, with which the carpenter of the present day requires to be familiar.

In the new book, indeed, the old foundations that have stood the test of half a century of practical use have been retained, but **the superstructure is wholly new.**

The lesson to be learned from this fact is not far to seek. It is that the modern carpenter requires a **far wider expert knowledge** than sufficed his predecessor. The development of wood-working machinery, the introduction of new kinds of timber, improvements in the design of structures, the more thorough testing of timbers, and progress in the various industries with which Carpentry, Joinery, and Cabinet-making are intimately allied, have all helped to render the craft more complex. The carpenter of the present day has no use for the old "rule of thumb" methods; his calling is both an art and a science, and **knowledge, knowledge, and again knowledge** is the primary condition of success.

The editor of THE MODERN CARPENTER, Mr. G. Lister Sutcliffe, Associate of the Royal Institute of Architects, **needs no introduction** to practical men; his name is already well known not only through his professional position in the architectural world, but through his editorship of *Modern House-Construction*, a work which, although issued only a few years ago, has already become a standard book of reference. Mr. SUTCLIFFE's large experience has enabled him to enlist the services of a **highly-qualified staff of experts**, whose special knowledge, acquired through long years of practical work, is now placed at the disposal of every member of the craft. The first condition in selecting the contributors to the work was that they should be **practical men**, not only possessing the indispensable knowledge, but having the ability to impart it. The result is that within the eight divisional-volumes of this work we have a treatise on every branch of the craft, distinguished by four outstanding qualities:—It is (1) **complete**, (2) **clear**, (3) **practical**, and (4) **up-to-date**.

An idea of the scope of THE MODERN CARPENTER may be gathered from the fact that while its predecessor, *The Carpenter and Joiner's Assistant*, comprised only **eight** sections, the new work includes no fewer than **sixteen**. A glance at these will show that the work **covers the whole field**; it is a complete encyclopædia upon every subject that bears upon the everyday work of the practical man.

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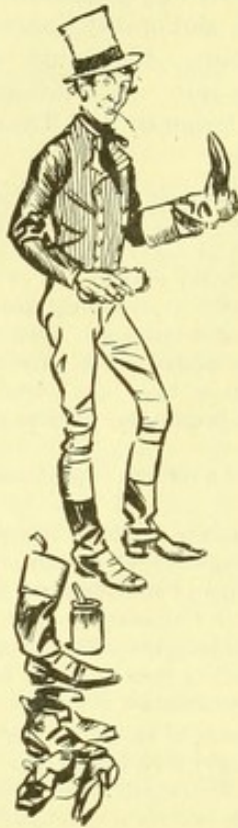
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- XII. Wood-Carving.
- XIII. Shop Management.
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The Illustrations are not the least of the many notable features of this great undertaking. The work is embellished in the first place with about **100 full-page plates**, reproduced, some in colours, by the most approved processes of mechanical engraving, and printed on specially-prepared paper. In addition to this unique collection there are no fewer than **1000 diagrams and designs** in the body of the work. No trouble or expense has indeed been spared to procure illustrations where these could elucidate the text.

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