FERMENTED LIQUORS:

A TREATISE ON

BREWING, DISTILLING, RECTIFYING,

AND MANUFACTURING OF

SUGARS, WINES, SPIRITS,

AND ALL KNOWN LIQUORS, INCLUDING CIDER AND VINEGAR.

ALSO, HUNDREDS OF VALUABLE DIRECTIONS IN

MEDICINE, METALLURGY, PYROTECHNY,

AND THE ARTS IN GENERAL.

BY DR. LEWIS FEUCHTWANGER,

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143 MAIDEN LANE, NEW YORK.

With Wood-Cuts of

DISTILLING, RECTIFYING, AND VINEGAR APPARATUS.

PRICE TWO DOLLARS.

NEW YORK:
PUBLISHED BY THE AUTHOR.
1858.
Entered according to Act of Congress, in the year 1858,
BY DR. LEWIS FEUChTWANGER,
In the Clerk's Office of the District Court of the United States for the Southern District of New York.

R. C. VALENTINE,
STEREOTyper AND ELECTROTyPER,
81, 83, & 85 Centre-street,
NEW YORK.
PREFACE.

Numerous pamphlets containing recipes and guides for the distiller have of late years been promulgated; none, however, have realized the just expectations of those men who are trafficking in fermented liquors. They searched in vain for information, but could not find it, and were disappointed in their purchases. The subject of distilling and brewing has not been treated as a science, and the author conceived the idea that such a vacancy may be supplied by his humble efforts.

He has devoted several years to the investigation of this branch of chemistry, and has spent the greater part of his life in the study of natural history and philosophy; and he feels, therefore, that his claim for issuing a work bearing on these studies may have some weight with those persons who have long been acquainted with him.

Although he is constrained to confess that he was not fully prepared to send forth to the public a full and comprehensive treatise on such important subjects as the title-page would indicate, and would
have preferred prosecuting his experiments for a longer time, so as to be fully satisfied himself that his labors will be crowned with success, and that his contributions on the subjects treated of should give unqualified satisfaction; yet, receiving numerous pressing letters and calls from a great many of his city and country customers,—who presumed that, being a manufacturer, importer, and dealer of the various essences, flavorings, and essential oils, he would be capable of giving at once every desired information,—and not wishing, by a refusal, to impede the progress of his business relations, he has set to work and compiled the following pages, imperfect and incomplete as they may be, which will contain many new preparations, manipulations, secrets, and drawings, that never appeared in print; and he trusts that his present efforts may prove useful and lucrative to his friends.

The author begs to call the attention of his readers to a number of subjects which have been introduced in this treatise, and which are altogether novel and instructive; such as the new rectifying process, and substances more effectual for the rectifying tubs; the apparatus for converting whisky into strong vinegar, within twelve hours, at a very trifling cost; the artificial cider, at less than half the usual price; and the manufacture of many wines and other liquors, never before made public.
PREFACE.

The experience of thirty years' active life in his profession, of a Practical Chemist—his desire to keep pace with the advancement of science, and to manufacture all the new productions used of late years in medicine and the arts, have given him many advantages; and he thought it advisable to communicate these stores of information to the public.

Part II. treats on Hygeine, relating to health, enumerating the most common diseases, their remedies, and medical cases, for family use; also describing hundreds of nostrums got up by empirics for the sake of gain.

Part III. is the Polytechnic and concluding part. It comprises many new alloys employed in metallurgy, chemicals used in ambrotyping, artificial guano or fertilizers, artificial gum arabic, and a description of all the artificial gems, and how to imitate them; on bleaching of shellac and wax; on cleaning, clearing, and cleansing mixtures; on cements, from that for filling cavities of teeth to that of an iron retort; on colored fires, a part of pyrotechnics, giving many new mixtures for colors which are cheap; many new prescriptions in cosmetics, such as soaps, Cologne and other perfumed essences; dentifrices, hair-dyes and invigorators; on ink and varnishes, and many other preparations highly useful to the druggist, chemist, perfumer, and the mechanic. All these prescriptions will be of considerable benefit;
and we trust that many grateful acknowledgments await us from those who will amass fortunes by the information acquired through our advice.

The books which the author has, for the compilation of the following pages, consulted, are Johnson's Chemistry of Common Life, Booth's Encyclopedia, Wright's Cordialanica, and Percy's Lexicon.

THE AUTHOR.

New York, March, 1858.
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FERMENTED LIQUORS.

CHAPTER I.

§ 1.

Fermentation.—The word fermentation means a spontaneous change, undergoing in solutions containing sugar, under certain circumstances. In the production of beer, which is the result of fermentation, the sugar is derived from the malt; in that of wine, it is from the juice of the grape; and no vegetable juice can be made to undergo the process of fermentation perfectly, if sugar is not contained in it in a considerable degree. The product of fermentation is an intoxicating liquid, called alcohol. The alcoholic or vinous fermentation is therefore the change of a saccharine solution, with the presence of yeast or ferment. The juice of fruits ferments spontaneously, as it incloses both the ferment and sugar. To the infusion of malted grain, ferment (yeast) is added; but, after fermentation, the quantity of yeast is increased, being formed from a substance existing in the grain. A number of substances produce their own peculiar fermentations, such as the vinous, acetous, putrefactive, lactic, butyric, and other fermentations. In the vinous fermentations, alcohol and carbonic acid are formed by the decomposition of the sugar contained in solution; but also a yellow or gray insoluble substance, containing a large quantity of nitrogen, is produced, which is called ferment, having the
power of inducing fresh fermentation in a new solution of sugar, and which has its origin from the azotized constituents of the juices called gluten, or vegetable albumen. It is certain that the wort, or infusion of malt, contains the azotized matter of the wort, or the gluten, and that the ferment is formed from the gluten at the same time that the transformation of the sugar is effected, in the same condition as the gluten exists in the juice of grapes. The wort ferments by the addition of yeast; but after its decomposition is completed, the quantity of ferment or yeast is found to be thirty per cent. greater than it originally was. The yeast from beer and that from wine are quite identical.

§ II.

As sugar forms the base, and the ingredient from which our brewers and distillers manufacture their liquors, it is of some importance that the reader should be made familiar with all the varieties of sugar.

The ancient world knew only the honey, grape, manna, and fruit sugars. In the present age we have added the cane, maple, beet, corn, and palm sugars. Sugar is also manufactured from potatoes and other substances rich in starch; from chickweed, sawdust, and from the milk of our cattle.

The numerous varieties of useful sugars are arranged under four heads, which are—I. The grape sugars; II. The cane sugars; III. The manna and liquorice sugars; and, IV. The animal or milk sugar.

I. The grape sugar has again five varieties, which are,—1. Sugar of the grape; 2. Sugar of honey; 3. Sugar of fruits; 4. Sugar of potatoes, or starch sugar; and, 5. Elderberry sugar.

1. Grape Sugar.—The ripe grape, when dried, forms the well-known raisin. In this, when opened, are numerous whitish crystalline brittle grains, which are sweet to the taste.
This is called the grape sugar, which dissolves readily in water, and if yeast be added to the solution, soon enters into fermentation.

The result of this fermentation is a spirituous liquor resembling wine, and afterwards, by continued fermentation, an acid liquor, like sour wine or vinegar.

2. *Honey Sugars.*—Honey is formed, or naturally deposited, in the nectaries of flowers, and is then extracted from them by the working bees; this they deposit in their crop, or honey-bag, and from this receptacle disgorge it again when they return to the hive. When liquid honey is allowed to stand for a length of time, it gradually thickens and consolidates; by pressure through a linen bag, a white solid sugar, consisting of minute crystals, remains, while the semi-fluid syrup runs through it.

3. *Fruit Sugars.*—The apple, pear, plum, peach, gooseberry, currant, and cherry, contain and owe their sweetness, acquired when fully ripened, to grape sugar, and the same may readily be extracted; they are mostly, however, either dried or made wine of.

4. *Potato or Starch Sugar.*—It is a property of starch of all kinds to be insoluble in cold water, but to dissolve in boiling water, and to thicken into a jelly as it cools; but if a small quantity of oil of vitriol (sulphuric acid) be added to the water in which it is boiled, the solution gradually acquires a sweet taste, and ultimately the whole of the starch is converted into grape or honey sugar. A pound of acid, diluted with one hundred pounds of water, will convert a great many pounds of potato, wheat, or sago starch into sugar. If the acid be then separated by lime, and the liquor boiled down better, a rich syrup or a solid sugar may be obtained. Instead of sulphuric acid, we may mix with the water twelve to fifteen pounds of malt for every one hundred pounds of starch; heat for three hours to one hundred and...
sixty degrees, and filter and evaporate the syrup. This sugar is much used in Europe for sweetening, for adulterating cane sugar, and for the manufacture of spirituous liquors. The French confectioners employ this syrup extensively, and brandy is distilled from it in Northern Europe.

Instead of starch, woody fibre, paper, raw cotton, flax, cotton and linen rags, and sawdust, may be transformed into sugar by digestion in diluted sulphuric acid. This operation is explained by the acid first changing the fibre into starch, and then the starch into sugar. Likewise Iceland and Irish moss and Ceylon moss, and other sea-weeds which form a jelly when boiled in water, may be converted into grape sugar, when digested in diluted sulphuric acid.

5. Elderberry Sugar.—The sugar obtained from the elderberry resembles likewise grape sugar, but differs somewhat in other properties.

II. The plants or fruits which possess distinctly acids, or sour juices, yield grape sugar; those which have little acid in their saps, contain for the most part cane sugar. The varieties of the sugar-cane are,—1. The Cane; 2. Beet; 3. Palm or Date; 4. Maple; 5. Corn Sugar.

1. Sugar-cane or Chinese Sugar.—The soil where the sugar-cane grows is within the torrid zone, and at low elevations; it forms, in many tropical regions, a staple part of the ordinary food: the ripe stalk of the plant is chewed and sucked, and in the markets of Manilla and Rio Janeiro, in New Orleans, and in the Sandwich and other islands of the Pacific Ocean, affords food for the inhabitants. The nutritive property of the raw juice of the sugar-cane arises from the circumstance that it contains, besides the sugar to which its sweetness is owing, a considerable proportion of gluten, as well as of those necessary mineral substances which are present in all our staple forms of vegetable food. The juice of the sugar-cane varies in composition and richness with the
variety of cane, the nature of the soil, the mode of cultivation, and the dryness of the season. Its average composition in sugar plantations, when the canes are fully ripe, is—sugar from 18-22 parts in 100, water and gluten 71 parts, woody fibre 10 parts, and saline matter 1 part.

The sugar is extracted in the following manner: the canes are cut, the leaves and tops are chopped off and left in the fields, while the under or ripe part is carried to the mill, where the ripe canes are passed between heavy iron crushing-rollers, which squeeze out the juice; this is run into large vessels, where it is clarified by the addition of lime or bisulphide of lime. This operation has a twofold object: it removes or neutralizes the acid which rapidly forms in the fresh juice, and at the same time it combines with the gluten of the juice and carries it to the bottom. This gluten acts as a natural ferment, causing the sugar to run to acid, and it requires to be speedily removed. After being clarified in this way, and sometimes filtered, the juice is boiled down rapidly and run into wooden vessels to cool and crystallize. It is finally put in perforated casks to drain; the raw or muscovada sugar remains, and the drainings are the molasses. The molasses and skimmings are fermented and distilled for rum.

The cane-sugar is much sweeter than the grape sugar, and dissolves more readily in water; for one pound of cold water dissolves three pounds of cane, and but one pound of grape sugar.

2. Beet-root Sugar is obtained from the sliced beet-root being squeezed out and the juice boiled down. When raw, it possesses a peculiar unpleasant flavor, but when refined it is scarcely distinguishable in any respect from that of the sugar-cane.

3. Palm or Date Sugar.—Most trees of the palm tribe, such as the date-palm, gomuti-tree, the sap of the cocoa-nut
tree, and wild date-palm, yield a copious supply of sweet juice when their top shoot or spadix is wounded. This palm-sugar, from whatever tree it is extracted, is exactly the same species of sugar as that yielded by the sugar-cane.

Other non-acid fruits, like the melon, chesnut, and cocoa-nut, contain cane sugar.

4. *Maple Sugar.*—This sugar is only prepared in the eastern section of the United States, where the maple-tree grows in abundance. It is identical with pure sugar-cane in all its properties.

5. *Maize or Indian Corn Sugar.*—The green stalks of the corn contain a sweet juice which, when boiled down, yields an agreeable variety of cane sugar.

6. *Sorghum Sugar,* extracted in China from the dhurra plant, is likewise a species of the cane sugar. It has of late been cultivated in the northern part of the United States with a satisfactory result. It promises to be at a future day a great rival to the sugar-cane.

III. *Manna and Milk Sugars.*—These sugars are less sweet than the previous ones, and do not ferment when mixed with yeast.

1. *Manna* of the ash-tree, chiefly cultivated in Sicily and Calabria, is from the sap of the tree, which hardens on the outside of the tree. This manna contains two kinds of sugar: one-third of its weight is gum; one-third of white crystalline sugar, called mannite; and only about ten per cent of a sugar resembling grape sugar, which ferments with yeast. It is the large quantity of gum which diminishes its sweetness.

This species of sugar is contained in many sea-weeds and mosses, also in the common celery and dandelion roots.

2. The gum-tree manna of Australia and Van Dieman's Land. This is sometimes seen to fall like a shower of snow over a large district, when the wind blows. The sweet
substance exuding from the leaves of the gum-tree, drying in daytime in the sun, is carried off at night. It is a peculiar crystallizable sugar. It is probably the same sugar which even in this country, and last year in Utah, was found on the leaves in large quantities.

3. Manna sugar from many trees, such as an oak in Kurdistan, the European larch. The manna from the pine of Mount Lebanon, is much esteemed in Syria as a remedy for affections of the chest. The Persian manna or gen—in Persia, Bokhara, Arabia, and Palestine—serves as food for camels, sheep, and goats. It is obtained from the camel's thorns, and is gathered by merely shaking the branches of the same.

The manna of the Old Testament is the Tamarisk manna, growing abundantly in the neighborhood of Mount Sinai. The tree called the tarfa-tree resembles much the weeping birch-tree, and the manna flows out in drops from the extremities of its slender boughs.

4. The Orcin manna is a sweet substance existing in certain species of lichen.

The liquorice sugar, generally known as Spanish liquorice juice, is the extract of the liquorice root. A large tree of Southern Europe. It differs in flavor from all other sugars; does not crystallize, nor does it ferment with yeast. It is used by brewers in the manufacture of porter.

5. Milk sugar. A peculiar species of sugar is contained in the milk after the curd is separated in making cheese. Its sugar remains in the whey, and is obtained in crystals by boiling the same down to a small bulk; it is hard and gritty, less soluble and less sweet than cane sugar, and it occurs in plants only in the acorn.
CHAPTER II.

§ III.

Fermented Liquors.—Beer and wine are called fermented liquors, both deriving their elements from sugar. In the production of beer, the sugar is derived from the malt; in that of wine, from the juice of the grape.

When grape sugar is dissolved in water, and a little yeast is added to the solution, it begins speedily to ferment. During this fermentation, the sugar is split up into three different substances—alcohol, water, and carbonic acid. The first two remain in the liquid, while the carbonic acid gas escapes as bubbles into the air; and chemical analysis proves, beyond a doubt, that one atom of grape sugar having the number 40—consisting of 12 parts of carbon, 14 parts of hydrogen, and 14 parts of oxygen—will contain the same number of the products just described, viz.:

<table>
<thead>
<tr>
<th>2 parts of alcohol, composed of</th>
<th>8 parts Carbon.</th>
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<tbody>
<tr>
<td>12 &quot; Hydrogen.</td>
<td></td>
</tr>
<tr>
<td>4 &quot; Oxygen.</td>
<td></td>
</tr>
<tr>
<td>4 &quot; Carbon.</td>
<td></td>
</tr>
<tr>
<td>4 &quot; carbonic acid, &quot;</td>
<td></td>
</tr>
<tr>
<td>0 &quot; Hydrogen.</td>
<td></td>
</tr>
<tr>
<td>8 &quot; Oxygen.</td>
<td></td>
</tr>
<tr>
<td>0 &quot; Carbon.</td>
<td></td>
</tr>
<tr>
<td>2 &quot; water,</td>
<td></td>
</tr>
<tr>
<td>2 &quot; Hydrogen.</td>
<td></td>
</tr>
<tr>
<td>2 &quot; Oxygen.</td>
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<td>40</td>
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1 part grape sugar... = 12 14 14 = 12 14 14

<table>
<thead>
<tr>
<th>2 parts alcohol.</th>
<th>8 12 4</th>
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<tbody>
<tr>
<td>4 &quot; carbonic acid.</td>
<td>4 0 8</td>
</tr>
<tr>
<td>2 &quot; water.</td>
<td>0 2 2</td>
</tr>
<tr>
<td>12 14 14</td>
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</table>
The same phenomenon takes place with cane sugar; as also with starch, converted into grape sugar by the action of dilute sulphuric acid; or of a mixture of malt, if yeast is added to the sweet solution. The starch of barley and other grains is converted into grape sugar before it is removed from the seed, and is then split up as before, by means of yeast, into the same elements just described.

These grains, or cereals, consist more especially of two principal substances—starch and gluten. When moistened, and under favorable circumstances, the grains begin to sprout, and a chemical change begins to take place: the gluten is changed, among other products, into a white soluble substance called Diastase, and the starch into soluble grape sugar; hence the sweetness of the sprouted barley. This natural change in the constituents of sprouting grains forms the art of brewing.

Malt beers owe their appellation to the fact that they are manufactured, wholly or partially, from malted barley.

§ IV.—Beer.

1. Malt.—When barley is moistened—that is, by adding nearly its bulk of water over it—put in heaps, spread on a floor in a dark room to heat and sprout, and the germ is about to burst from the envelop of the seed, the growth is arrested by drying the grain gently on the floor of the kiln. It is then malted barley, has a sweet taste, showing that it contains sugar. Corn, oats, wheat, and rye may be converted into malt by a similar process.

2. Beer.—The malt is now bruised and introduced into the mash-tun, with warm water of 160° temperature, with rather more than its bulk of water; the mixture is stirred up for a few hours, then the liquor is run off, and more water added, until the malt is exhausted. These infusions are called wort, and the proper strength of the same on the
saccharometer scale is 0° at 70° temperature, or of a specific gravity 1.100.

Hops are now added to the fresh boiling wort, to one-twentieth of the weight of the employed malt. The object of the use of hops is to cover the sweetness of the liquor by an aromatic bitter, and to diminish its tendency to acridity, and also to assist in clarifying it.

The boiled liquor is run off into shallow vessels, and cooled as rapidly as possible to the best fermenting temperature, 60° Fahr.; it is then transferred to the fermenting vat, and, a sufficient quantity of yeast being added, allowed to ferment slowly for six or eight days. During this fermentation, the sugar of the wort is split up into alcohol and water, which remains in the beer, and into carbonic acid gas, which mostly escapes. The liquor becomes then clear, has lost much of its sweetness, and, diminished in its specific gravity, acquired a new flavor, and become an intoxicating liquor.

3. The Zeilithoid, or new Beer Generator, or grainstone, introduced since 1852 by Rietsch, in Austria, for the purpose of producing beer in the cold way, is nothing but an extract of grain (barley), and an addition of hops, and is a hard, yellow, tough mass, which does not spoil by keeping, but, when required for use, is dissolved in water, and fermented by yeast: a good beer, according to the quantity of material, is obtained in a very short time. This beer may be made on long sea-voyages, and in hot climates, in quantities to suit, for immediate use.

4. The Extract of Malt is the same as the above, obtained by the evaporation of ready prepared beer to dryness, and its composition is undecomposed sugar, soluble gluten, from the grain, and bitter substances from hops, and yields about eight per cent. from good beer. The nutritive qualities of beer depend upon the amount and nature of this extract, and the less fermented beers contain most of the extract. English ale
BRE WING, DISTILLING, AND RECTIFYING.

contains four per cent.; small beer, fourteen per cent.; while the German drinks, scarcely half fermented, contain as much as thirty-nine per cent.

5. Beer contains, as a matter of course, alcohol, the result of fermentation; and this varies in quantity quite as much as the extract. For instance:

- Small beer contains but 1½ per cent. alcohol.
- Porter " 5½ " "
- Brown stout " 6½ " "
- Bitter and strong ale " 10 " "

And upon this alcohol depends the intoxicating effect of malt liquors. The English ales contain about the same strength, and have the same influence, as hock and light French wines. Beer is moreover food as well as drink, on account of the large amount of nutritive matter it contains, and is only distinguished from wine by the bitter, narcotic principle of hop.

The Chica, or Indian-corn (maize) Beer, which is a common drink of South America, is prepared in the same manner as any other beer. Indian corn is malted instead of barley; and the liquor after fermentation is of a dark yellow color, and has an agreeable, slightly bitter, acid taste. This universal beverage, along the west coast of South America, is the only beverage of the country. The Chica mascada is the chewed corn, used for converting it into the chica. It is considered far superior to that prepared from corn crushed in the usual manner; and the hosts in the valleys of the Sierra know no greater luxury to offer their guests and strangers than a draught of the chica mascada, the ingredients of which have been ground between their own teeth.

7. Bouza, or Millet Beer, or Murwa, is a fermented beer from millet seed. Among the Crimean Tartars, it produces an excessively astringent beverage. On the southern slopes
of the Himalaya mountains, the millet beer is in general use, where it is drank while still warm; is served in bamboo jugs, and sucked through a reed. It tastes, when fresh, like the negus of Cape Sherry.

8. The Quarf, or Rye Beer, is a favorite Russian drink, resembling the bouza in taste and appearance, except that it is made from fermented rye flour.

9. The Koumiss, or Milk Beer, is a fermented liquor, produced by the addition of yeast to milk. It is the milk sugar, along with the curd and butter, which produces the fermentation, transforming it into alcohol and carbonic acid. Mares' milk is richer in sugar than the milk of the cow. It takes two days for preparing, and has a sourish taste. In a cool place, in close vessels, it may be preserved for several months. It is always shaken before it is drank. It is a nourishing as well as exhilarating drink, and is not followed by the usual bad effects of intoxicating liquors. It is even very beneficial in dyspepsia and in general debility. It is very easily prepared by diluting new-milk with one-sixth of its bulk of water, adding a quantity of starch, and covering the whole up in a warm place for twenty-four hours. It is then churned together till the curd and whey are intimately mixed, and is again left at rest for twenty-four hours. It is then put into a tall vessel, and agitated till it becomes perfectly homogeneous. This beer is the favorite drink of the Tartars. The Arabians and Turks prepare a similar milk beer.

10. The Ava, Cava, or Arva, is a beer prepared from the root of the long pepper, and is in use in the South Sea Islands, all along the Pacific Ocean, in Tahiti, Sandwich Islands, Tonga Islands, and Feejee Islands. It is similar in its preparations to the chicha. The root is chewed, either fresh or dry, as the Indian chews the maize; the pulp is then mixed with cold water, which after a little while is strained
from the chewed fibre, and is ready for use. None but young persons, who have good teeth, clean mouths, and have no colds, are employed in this operation. The women often assist in chewing the ava root in the Tonga Islands. The ava drinking of the king at Somu-somu, one of the Fijian Islands, is very peculiar and attended with much ceremony, both religious and political.

§ V.—GENERAL REMARKS ON BEER.

The difference in the varieties of beer is of course in the materials employed for the production of fermented liquors, or in the process and management of brewing. Malt beer differs according to the kind of malt employed, and according to the proportion of hops and water. It differs from wine, not only in containing less alcohol, but also in containing a much larger quantity of nutritive matter. It owes also its intoxicating property to the bitter and narcotic ingredients of hops. The specific gravity of small or table beer never exceeds 1.025, and contains about 5 per cent. of the malt extract, while ale, such as Burton's, is as high as 1.111; porter, 1.055; and brown stout, 1.072. The color of the beer depends upon the color of the malt, and the duration of the boiling in the copper kettles. Pale ale is made from steam or sun-dried malt, and the young shoots of the hop; amber ale, from a mixture of pale, yellow, and brown malt; dark-brown beer, from partially carbonized or parched malt; and porter from high-dried malt,—hence its deep color, and the absence of any sweet taste, having lost by heat its saccharine matter; while ale has a sweetish taste, and contains a much larger quantity of saccharine matter. A main feature of good beer is its fine color and transparency. Various substances are used for refining, muddy or foul beer, such as isinglass and Irish moss; and some brewers add even the Iceland moss, which not only assists in clarifying, but also
in imparting a pleasant bitter taste. The temperature and the manner in which the worts are made to ferment have a remarkable influence upon the quality of beer, especially in reference to its fitness for keeping.

§ VI.

There are two kinds of fermentation, the upper and the lower or bottom fermentation. The former is a much more active fermentation; the gluten is only partially oxydized at the expense of the oxygen of a portion of the sugar, while a great portion remains dissolved in the liquor, and by its subsequent oxydation is apt to transfer oxygen to the alcohol and render it sour, unless it be kept at a very low temperature. This is still more the case, if, during too violent a fermentation, the temperature rises too high, and especially if the air be not perfectly excluded, or a considerable quantity of acetic acid be formed, by which an additional quantity of glutinous matter is dissolved; and it thus is not only apt to spoil from the slightest causes, but loses also its liquidity, and assumes a disagreeable taste, what is called yeast bitten.

By the lower fermentation, on the contrary, the conversion of the sugar into alcohol is performed very slowly, and without any considerable rise of the temperature; so that the gluten is completely oxydized and precipitated by the oxygen of the air, and without conversion of the alcohol into acetic acid; so that the resulting beer—as all the Bavarian beers for example—is not liable to become sour. When this is not the case, the tendency to become sour is generally remedied by a large addition of hops and a greater proportion of malt, by which the beer becomes more narcotic and intoxicating, and less agreeable to the taste.
§ VII.—Ales and Beers.

1. The Scotch ale is characterized by its pale amber color and its mild balsamic flavor, and the bitterness of the hop is so mellowed with the malt as not to predominate. The low temperature at which the Scotch brewer operates in the colder months of the year, and his nicety in selecting his malt and hops, will always keep him pre-eminent to the other manufacturers of the world.

2. The Bavarian beer is fermented very slowly, and at a very low temperature, by the so-called lower or bottom fermentation; and it is incapable of undergoing the acetic fermentation, even by free exposure to the air. It keeps for years without turning sour. In the south of Germany a light beer is prepared from various amylaceous substances besides the barley, such as potatoes; beans, turnips, beets, carrots, &c.

3. The Strasburg ale is mainly manufactured from mashed potatoes, mixed with about one-tenth of their weight of ground barley malt. This is mixed with some water, and exposed in a water bath to a heat of 160°, whereby it is partly converted into saccharine matter, and may then be boiled with hops, cooled and fermented into beer.

§ VIII.

There are several kinds of beverages called beer, par excellence, but very improperly, as they are made from saccharine liquors, and advanced more or less into the vinous fermentation, and flavored with peculiar substances; such as spruce, ginger, and root-beer, which I will shortly enumerate in their place.

1. Ginger-beer.—This beverage, a favorite summer drink in the United States, is prepared quite simply in the following manner: To 3 gallons water add ½ pound bruised gin-
ginger-root, 2 ounces cream tartar, and 4 pounds sugar; boil for a few minutes, and after cooling, add about 1 gill of fresh yeast; cover up the vessel with a thick flannel, and let it stand over night; add a little essence of lemon, strain it, and bottle the liquid in clean bottles, and tie the corks down by means of twine or iron wire: on the fourth day the beer is fit to drink.

Another English ginger-beer is prepared by boiling 1½ ounces pulverized ginger, 1 ounce cream tartar, 1 pound sugar, with ⅔ gallon water; when cold, add a little yeast (a tablespoonful); the following day it is filtered, and drawn into bottles and well corked.

2. Spruce beer is prepared by putting into the common soda-water bottles about half a drachm (30 grains) of supercarbonate of soda, some essence of spruce (about 10 drops), and about half a drachm of crystallized tartaric acid; fill the bottle quickly with spring-water, cork, and tie it with twine.

3. The most agreeable Lemonade gazéuse, or portable lemonade, is obtained by boiling down the sugar syrup until it becomes feathery; it is then broken up and weighed, and thrown into bottles containing the solution of cream of tartar and bicarbonate of soda, when no carbonic acid can escape.

4. Root-beer is prepared by boiling various roots kept by the Thompsonian herb dealers, such as sarsaparilla, comfrey, liquorice-root, and sassafras blossoms and bark, in the same way as the ginger: and by adding to every two gallons of such decoction about two pounds of sugar; and when dissolved, add a gill of yeast to the same quantity, let it ferment over night, and the following day the beer is fit for drinking.

5. Lager-bier, the most popular drink in the United States, is prepared only in the winter months, and in the same manner as the Bavarian beer. The quantity of lagerbier consumed in the United States is incredible; for, in the
city of New York there are about twenty breweries: their production during the winter months is 30,000 gallons each, which will give for the city 6,000,000 gallons, a very low estimate. The beer keeps in the large vaults very well without becoming sour, and some beer tastes very well after being brewed a year.

The lager-bier establishments in this city, Brooklyn, Williamsburgh, and Staten Island, are very extensive, and large fortunes have been realized since its introduction into this country.

§ IX.

Adulterations are often practised in the manufacture of beer, for the purpose of imparting a heading or frothing, or giving it a bitter taste: alum, salt, and gentian-root are added for the latter; capsicum, grains of paradise, ginger-root, coriander-seed, and orange-peel, are also added to give pungency and flavor: also cocculus Indicus, quassia, tobacco leaves, yarrow-herb, stramonium-seed, calamus, coloring, coppers, aloes, ragicakes made of onions, black pepper, and capsicum, are all substances more or less used for adulteration of beer. For the purpose of giving age to new beer, or make it taste as if eighteen months old, some sulphuric acid is added.
CHAPTER III.

WINES.

The distinguishing characteristics between wine and beer are, that beer quenches the thirst, exhilarates the spirits, and is, at the same time, nourishing, which is not the case with wine. Wine, however, is free from all bitter or narcotic ingredients. Wine is also produced by a spontaneous fermentation, without the addition of yeast.

§ X.—APPLE WINE OR CIDER.

The expressed juice of the apple contains grape sugar already formed. When left to itself, it begins to ferment without the addition of yeast, and during this fermentation the sugar is converted into alcohol. Cider differs in flavor, in acidity, in strength, as also in quality. The kinds of apple which are grown and used for the purpose, the degree of ripeness they are allowed to attain before they are gathered, the time given them to mellow or ferment before they are crushed, the skill with which the several varieties are mixed before they are put into the mill, the nature of the climate, the character of the season, the quality of the soil—all these circumstances materially affect the quality of the expressed juice as it flows from the crushing-mill; and then again, the after-treatment of the juice may produce a difference in the ripe ciders. There are certain characteristics in which all ciders agree: they are refreshing, contain little extractive or solid nutritious matter, but neither a bitter nor a narcotic ingredient. They contain on an average nine per cent. of alcohol. In strength, cider resembles the common hock-wine.—
Cider soon runs to acid, or becomes sour: it is then called hard cider.

The manufacture of cider is as follows:

The expressed juice from the apples, right after coming from the mill, is thrown into casks, with bungs lightly covered, but quite full to the brim, for a fortnight; and after six weeks the liquor is drawn off. An addition of five pounds of sugar to the barrel, causes the cider to become more vinous: apple-juice, quickly boiled and made into syrup, if added, will produce a pure cider. An addition of five per cent. of starch sugar will assist materially in increasing the strength and make it keep longer.

Imitation Cider.—In many parts of the country where cider is not made, and commands therefore a high price, the cupidity of the trader in that article is stimulated to adulterate it; and I have examined several times such a cider, which has been produced by the mixture of five gallons good sweet cider, two gallons fruit vinegar, or common wine vinegar, two gallons white syrup made from sugar, to twenty-five gallons of water. In one instance, I could distinguish a very small quantity of the oils of apple and pear, say one ounce of each to the barrel. This imitation cider tastes very well; and by adding about one gallon of purified whisky, may be made to keep for a length of time.

§ XI.—Wines Proper.

Grape Wine.—The fermented juice of the grape is the wine proper. This juice, like that of the apple, contains the ready-formed grape sugar, and it enters speedily into spontaneous fermentation, just like the juices of the apple, the pear, the gooseberry, the currant, and other fruits. Within half an hour, in ordinary summer weather, the clearest juice of the grape begins to appear cloudy and to thicken, and to give off bubbles of gas. Grape wine differs in a multiplicity
32

Fermented Liquors.

of circumstances in itself,—in the climate of the country, the nature of the season, the soil of the locality, the variety of the grape, the mode of culture, the time of gathering, the way in which the grape-fruit, when gathered, is treated and expressed, the mode of fermenting the juice or must, the attention bestowed upon the young wine, and the manner in which it is treated and preserved.

§ XII.

All wines contain a certain quantity of alcohol, according to the quality and kind. It varies even in the same kind. The Spanish and Portuguese wines contain three times more alcohol than those of France and Germany.

<table>
<thead>
<tr>
<th></th>
<th>Port contains on average, by measure, 20 per cent.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sherry;</td>
<td>&quot; &quot; &quot; 25 &quot;</td>
</tr>
<tr>
<td>Madeira,</td>
<td>&quot; &quot; &quot; 20 &quot;</td>
</tr>
<tr>
<td>Claret,</td>
<td>&quot; &quot; &quot; 12 &quot;</td>
</tr>
<tr>
<td>Tokay,</td>
<td>&quot; &quot; &quot; 10 &quot;</td>
</tr>
<tr>
<td>Rhenish,</td>
<td>&quot; &quot; &quot; 12 &quot;</td>
</tr>
<tr>
<td>Burgundy,</td>
<td>&quot; &quot; &quot; 12 &quot;</td>
</tr>
<tr>
<td>Moselle,</td>
<td>&quot; &quot; &quot; 9 &quot;</td>
</tr>
<tr>
<td>Champagne,</td>
<td>&quot; &quot; &quot; 10 &quot;</td>
</tr>
</tbody>
</table>

The grape wine contains more or less undecomposed grape sugar, which gives a sweet taste and a fruity character to wines. Dry wines contain but little free sugar. Champagne wine, which contains but little free sugar, requires an addition of sugar, for the purpose of giving it body, to keep it sparkling, and to prevent its becoming sour. In fact, the sweetness of some wines, like Tokay, Malmsay, and Samos, and the extreme fruitiness of some port wines, is indicated by the large proportion of sugar which those varieties of wine sometimes contain.

§ XIII.

Grape wine contains a variable portion of free acid and
tartaric acid, but wines made from unripe grapes contain sometimes citric acid.

Tartaric acid exists in the juice of the grape, in combination with potash, and is called cream of tartar, or argols. This substance has a well-known sour taste. When the fermented juice is left at rest, this salt (bitartrate of potash) gradually separates from the liquor, and deposits itself as a crust or tartar on the sides of the casks or bottles; hence, by long keeping, good wines become less acid.

Grape wines owe their agreeable vinous odor, or flavor, to an ethereal substance, called Ænanthic ether, which, in a separate state, is a very light fluid, of a sharp and disagreeable taste, but having an odor of wine so excessively powerful as to be almost intoxicating. It does not exist in the juice of the grape, but is produced during the fermentation; and as the odor in old wines is stronger than that in new wines, it therefore increases in quantity. So powerful is the odor of this ether, that few wines contain more than 1/4 part of it in bulk. It is the general characteristic of all grape wines.

In combination with the Ænanthic ether, all wines contain one or more odoriferous, more or less fragrant, substances, to which the peculiar bouquet or scent of each is due. As these give the special character to the wine, they are more or less different in each variety. The bouquet is contained in even more minute quantity than the Ænanthic ether, and its nature has, as yet, escaped the examination of the chemist.

§ XIV.

Many wines are produced from the fermentation of various fruits and roots, a few of which I will here enumerate. The price of good wines, and the high duty imposed in this country, have induced many dealers to substitute almost every wine, either by taking 5 gallons of the genuine wine, and
adding 15 gallons of pure spirits, 15 gallons of water, and 2
gallons of white syrup; and add either sugar coloring (burnt
sugar), or in cases where the coloring does not produce the
desired color, juice of the cherry, whortleberry, or elderberry
is substituted. The quantity of water and pure spirits varies
according to the strength of the respective wine to be pre-
pared. A number of the wine-mixers do not use any genu-
ine wine for their compound, but rely upon their skill to
produce a beverage somewhat resembling a certain wine. In
this manner, port, sherry, Madeira, muscat, and claret wines
are falsified, and manufactured in this country by thousands
of gallons, and partly sold in original packages, or put up in
bottles, as the claret wine is disposed of in great quantities,
by dozens, at public sales in this city and New Orleans.

§ XV.

The wines are arranged in quality according to the fol-
lowing table.

RED WINES.

DRY WINES.

<table>
<thead>
<tr>
<th>FIRST CLASS.</th>
<th>GRENADY WINES.</th>
<th>CORDIAL WINES.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Château Lafitte,</td>
<td>Romanée,</td>
<td>Lacrimæ Cristi,</td>
</tr>
<tr>
<td>&quot; Margaux,</td>
<td>&quot; Conti, Richebourg,</td>
<td>Cap Constantin,</td>
</tr>
<tr>
<td>&quot; La Tour,</td>
<td>&quot; Château Vougeot,</td>
<td>Messire Ésence Chiras,</td>
</tr>
<tr>
<td>&quot; Haut Brion,</td>
<td>&quot; Chambertin,</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&quot; Hermitage, 1st quality.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SECOND CLASS.</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Château Rosan,</td>
<td>Volnay, Vosne,</td>
<td>Rivbailles, Pouil Guillot,</td>
</tr>
<tr>
<td>&quot; La Rose,</td>
<td>Pommard, Nuits, Beaune,</td>
<td>Pedro Ximenes, Malaga,</td>
</tr>
<tr>
<td>Juracciano, Bonzy,</td>
<td>Côte Rotie, Cahors,</td>
<td>Tinto de Rota, Aleatico,</td>
</tr>
<tr>
<td>Asnanshausen,</td>
<td>Benicarlo, Cassis, &amp;c.</td>
<td>Falerner.</td>
</tr>
<tr>
<td>Erlau, Port.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>THIRD CLASS.</th>
<th></th>
<th>THE RED MUSCAT WINES OF VARIOUS COUNTRIES,</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poulliac, St. Julien,</td>
<td>Comas, Marséller,</td>
<td>Piccardan,</td>
</tr>
<tr>
<td>Persac, Mareuil Affenthal,</td>
<td>St. George, Geory,</td>
<td>Grenache Matchabé.</td>
</tr>
<tr>
<td>Valgarzheimeher,</td>
<td>Chassagne.</td>
<td></td>
</tr>
</tbody>
</table>
## WHITE WINES.

### FIRST CLASS.

**Dry Wines.**
- Château Johannisberg,
- Leisten, Stein, Berg,
- Markobrun, Geisenheim,
- Stiller.

**Greasy Wines.**
- Hermitage, Sauterne,
- Barsac, Mont Rachet,
- Ay, &c.

**Cordial Wines.**
- Tokay, Commandery,
- Riveault, Canarisect.

### SECOND CLASS.

**Scharlscherg.**
- Stein Wine, Raster,
- Xeres, Vino d'Oro, &c.

**Straw Wine of Würzburg,**
- Collmar, St. Peray,
- St. Jean, Condrieux,
- Madeira, &c.

**Malvoisier,**
- Montefiascone,
- Alicante, St. George,
- Calabrese, &c.

### THIRD CLASS.

**Leubenheim,**
- Markgräfler, Forster,
- Raudernacker,
- Rassmeyer,
- Czernosecker, &c.

**Landrach, Pyroles,**
- Cosmas, Langon,
- Blois Wine,
- Tenerife, &c.

**Linel, Piccardon,**
- Marsalla, Macabeo,
- Carcavelho, &c.

### § XVI.—THE FINING OF WINES.

Great care has to be used in pressing the grapes, fermenting the must, and settling the wines, in employing clean casks, and in keeping them constantly filled, else the fermented material cannot be removed. Notwithstanding all this, a new wine may from many causes—either the unfavorable season or some unknown mismanagement—be so situated as not to become clear. If we observe this heaviness of wine, the drawing off from one cask into another will remove the difficulty; but in case the wine is too cloudy and heavy, we have to resort to the clearing or fining operation, which is performed by numerous materials,—

1. By white sand, mixed with the white of eggs;
2. By small flint-stones:
3. By cream of tartar;
4. By isinglass, or fish sounds, or fish glue;
5. By gum-arabic and gum tragacanth;
6. By burnt and ground horn;
7. By filtering through felt;
8. By gelatine.
Isinglass and the white of eggs are mostly employed in effecting this object. Half an ounce of isinglass, soaked previously in one gallon of wine, and, when properly gelatinized, thrown in a barrel of the wine, will completely clear it in a week; and after a fortnight or three weeks, it may be drawn off into another barrel.

The neutralization of the wine, which is the case when old wine has become sour, or when young wine will not settle down its tartar, is done by adding a very small quantity of tartrate of potash, about one ounce to the barrel of such wine; and after the lapse of a week the wine becomes clear and free from acid.

§ XVII.—The Consumption of Wines.

The production of all the wines in Europe is 15,500,000 bottles, for a population of 240,000,000 souls.

In France, the largest culture and revenue is from wine, and more than six millions of the inhabitants are engaged in its traffic. It furnishes 525,000,000 bottles (40,000,000 hectolitres), at a value of 700,000,000 francs. The quantity of Champagne from the Department de la Marne is estimated at 2,700,000 bottles.

England consumes about 8,000,000 gallons; and their most favorite wines are the Portuguese red wine and Spanish Sherry wines—that is, fifty per cent. of Portuguese, forty per cent. of Spanish, and the rest of French, Cape, and Madeira wines. England produces a few fruit wines; such as cider, pear, and gooseberry wine—about 250,000 gallons in all.

Russia imports largely Champagne wine—about 800,000 bottles; also about 30,000 hogsheads of Greek and Moldavia wines, and but 50,000 gallons of French wines. Russia produces in the Crimea a considerable quantity of wine—about 500,000 hogsheads; in Bessarabia, nearly 3,000,000 gallons. The art of improving their native wines is well under-