is so high in flavoring ingredients that it is unsuitable for beverage use, as such. The chief uses are for blending with lighter rums or neutral spirits and for the fortification of hock and similar wines.

Rum Manufacture.—Jamaica Rum.—Rum is distilled from the by-products of sucrose recovery from sugar cane juice. The process of sugar recovery is here stated in brief outline to explain the origin of the raw materials for rum. The cane, within a few hours of cutting, is brought to the crushing mill. The lapse between cutting and crushing must be short to avoid losses of sucrose from various sources, especially inversion. Hence mills are usually rather small and serve only a limited territory. The sucrose content of the sugar cane varies from 10 to 18% of the total weight.

At the mill the canes are cut into short bits by the rapidly revolving knives of the cutter and then pass to a series of three-roll crushers which press out the juice. If no water is added the process is called "dry crushing." In "wet crushing" water is played on the cane at the second or third set of rollers. The pressed cane or "bagasse" may be treated for further extraction. The juice drops into troughs under the rollers and is strained, warmed to about 200° F. and left for a time in settling tanks.

Some sugar is still retained in the bagasse. Hence in some plants it is passed on an endless belt through a shallow trough containing water and then pressed once more in crushing rolls. This extract is added to the first juice.

The amount of juice in the cane varies according to district of origin and degree of maturity. About 60 to 80 per cent of the juice is extracted by the methods described and the juice conforms approximately to the following analysis:

<table>
<thead>
<tr>
<th>Component</th>
<th>Per Cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sucrose</td>
<td>14.1</td>
</tr>
<tr>
<td>Reducing sugars</td>
<td>0.6</td>
</tr>
<tr>
<td>Water</td>
<td>83.6</td>
</tr>
<tr>
<td>Undetermined solids</td>
<td>1.7</td>
</tr>
</tbody>
</table>

100.0
After settling, the juice, which is still turbid and has an acid reaction, is drawn into mixing tanks and treated with enough lime to make it slightly alkaline. This treatment results in the precipitation of a number of impurities. The limed juice is heated, and in about an hour albuminous material coagulates on the lime precipitate forming a crust, and the whole produces a thick scum.

After the juice has settled, the scum is removed and sent to the fermenting tank in the still house. The clear juice runs to evaporators, its sucrose content being about 14 per cent. In the first evaporation, it is concentrated to about 50 per cent sucrose. Further concentration is carried on until the desired point for proper crystal growth has been reached. The mass in the pan, then called "massecuite," contains a total of 82 per cent sucrose and perhaps 8 per cent water. Of the total sugar in the hot massecuite 56 per cent is in crystals and 44 per cent is in solution; after cooling 65 per cent has crystallized and 35 per cent remains in solution.

The thick semi-solid mass is placed in centrifugal baskets and "whizzed." The adhering solution which whirls off to the outside, is collected and stored as molasses. The crystals are first washed in the basket, then removed for shipment. They constitute the raw or centrifugal sugar which refineries buy.

The molasses may be concentrated again until all of its crystallizable sugar has been removed.

Fermentation.—In the meantime the scum which was sent to the fermenting pan in the still house was allowed to remain a few days until it soured, a certain amount of bagasse having been added to assist souring.

A mash is made up of diluted molasses containing about 25 to 30 per cent sugar and skimmings (sometimes juice is added). "Dunder" is also added. This is the name given to the spent liquor from the stills and has the color and consistency of pea-soup. It contains mineral salts, coagulated albuminoids and soluble nitrogenous substances; and not only stimulates fermentation but increases yield and has a distinct influence on taste and flavor:

The mash as mixed contains about 12 per cent fermentable
sugar. A vigorous fermentation soon sets in as a result of the sub-tropical climate and the composition of the mash. Fermentation is completed in about 6 to 12 days, sometimes longer, various organic acids being formed along with the alcohol.

**Distillation.**—Distillation is carried on in pot stills. The whole process must be carried out with a great deal of care. The first distillate has a nauseating odor and a raw burning taste so that it must be rectified to eliminate objectionable ethers, aldehydes and acids. It is also customary to trap off a portion of the total rectified distillate so that it may be used for blending with succeeding distillates.

**Demerara Rum.**—We are fortunate in having the following description of rum manufacture which is quoted from a “Communication of the British Guianas Planters Assn. to the British Royal Commission on Whiskey and The Potable Spirits, 1909.”

“In British Guiana the wort is prepared by diluting molasses with water to a density of 1,060 and it is rendered slightly acid by the addition of sulfuric acid in quantity sufficient to set free more or less of the combined organic acids, but so as not to have uncombined sulfuric acid present in the wash; whilst in some of the distilleries additions of sulfate of ammonia in small proportions are made to the wash, in order to supply readily available nitrogenous food for the yeasts and to thus enable them to multiply with rapidity and to retain a healthy active condition. The reason for rendering the wash slightly acid is to guard against the excessive propagation of the butyric and lactic organisms, and to render it more suitable for active alcoholic fermentation. Within a very short time from the molasses being diluted it enters into vigorous fermentation and rapidly proceeds to more or less complete attenuation in 30 to 48 hours.

In British Guiana the distilleries are of three kinds:

1. Those using pot stills or vat stills which are practically only modified stills.
2. Those using both pot stills or vat stills and Coffey or other continuous rectifying stills.
3. Those using only Coffey or other continuous rectifying stills.

Vat stills consist of cylindrical wooden vessels built of staves strongly hooped with wrought iron. They have high copper domes covering openings in the heads of the vessels which communicate with a retort or retorts of the Jamaica pattern, but, as a rule, the retort acts as the lowest vessel of a rectifying column. As in Winter’s still a spiral pipe or a series of
small perpendicular pipes descend down the interior of the column through which cold water is run whenever distillation is in progress, and by which the spirit vapor undergoes a process of rectification as it ascends the column before passing into the condenser. Vat stills are heated by injection of steam."

Aging.—The aging of rum does not differ markedly from the aging of whiskey (q.v.). The temperatures are possibly a little higher and the time somewhat shorter. Either charred or uncharred casks are used and a deficiency of color in the finished product is made up by caramel.

Imitation Rum.—The practice of "stretching" rum is quite common, either of two general methods being used. In the first method rectified grain alcohol is diluted, "cut," with distilled water until it is of the same alcoholic strength as a previously selected rum of strong bouquet. This diluted alcohol is then used to mix with the rum in any ratio from one-to-one to one-to-four or five parts of alcohol to one of rum. The mixture is aged in casks for several months at a temperature of about 75°F. The product of this treatment might possibly be better called a "cut" rum than an imitation. In the second method, a mixture prepared as just described but before aging is further "cut" with distilled water and redistilled. The new distillate is treated with "rum essence" and then aged in casks. Rum essence, or the so-called "pelargonic ether" is a mixture of esters, alcohol etc, prepared in various ways. One favored method is said to consist in distilling a mixture of alcohol, crude acetic acid, starch, manganese dioxide and sulphuric acid. Rum essence is quite generally used in the preparation of imitation rum and also as a cooking flavor. An experienced taster, however, would have no difficulty in distinguishing it from the genuine article.

GIN

There are two essential differences between gin and the liquors which have previously been under consideration. The major difference is that gin derives the bulk of its flavor from pre-existing natural essential oils rather than from the products of fermentation. Secondly, gin is somewhat more of an international product,
being made in the Continent especially Holland, in the British Isles and in the United States. In each country there are minor qualities which are distinctive. In general, however, gin is a colorless beverage containing from 40-55% of alcohol and having a perfume-like odor. It was originally made in Holland.

**Holland Gin.**—Since the production of alcohol for gin is a separate step from the introduction of the flavor it might seem that any sufficiently pure alcohol could be used in the manufacture of gin. As far as the American public is concerned, this is probably true. However, abroad, and especially in Holland, the congeneric substances of the pot-still distillate from a properly fermented mash of barley malt, rye and corn are required to round out the taste of the product. This distillate, called *moutwijn* or maltwine, is bought from distilleries by the gin manufacturers and redistilled by the latter through a "gin head" containing juniper berries and other flavoring materials. This is the material which under the various names "Geneva," "Hollands," "Hollands Geneva" or "Hollands Gin" has spread widely over the surface of the earth.

**English Gin.**—In England the same raw materials are used as in Holland. However, since the distillation of alcohol for use in gin is almost always done in patent stills, the flavor of the British gin is decidedly different from the Dutch. The English gin manufacturer usually requires a clean spirit which has been rectified until only a slight grain flavoring remains, as decided by the judgment of the operator. Molasses spirit is objected to both in England and the Netherlands on the ground that it gives a coarse flavor to the finished gin. The selected spirit is then made into gin in a number of ways. The more approved process is to re-distill the spirit, after dilution with water, in a pot-still equipped with a gin-head containing juniper berries and other flavoring materials as required. Some manufacturers, however, distill the flavoring materials separately and then add them to the diluted alcohol. Others distill before dilution, etc. The addition of from 2-4 or even 6% of sugar, or of ½-1% of glycerin to gin is common practice to sweeten and "smoothen" the product. Gin is usually bottled as made and is unaffected by aging.
American Gin.—In the United States gin is made from the usual grain mash with juniper berries as the principal flavoring agent. Sloe gin has in addition the flavor and color extracted from “Black-haw” or Sloe berries. Among the flavoring agents used in gin are the following:

- Angelica
- Anise
- Bitter Almonds
- Caraway Seed
- Coriander
- Calamus
- Cardamoms
- Cassia Bark
- Fennel
- Grains of Paradise
- Juniper Berries
- Orris Root
- Liquorice
- Turpentine
- Bitter Orange Peel

Turpentine is only occasionally used as a substitute for the essential oil of juniper. A small addition of sulphuric acid to the spirit before rectification is sometimes made to produce an ethereal bouquet and flavor.

Gin manufacture in the United States may be carried on along with the manufacture of whiskey and spirits. Its place in this unitized operation is shown in Fig. 26. A specialized plant for the manufacture of gin is shown in Fig. 34. The process is as follows: Pure spirit from the charge tank is drawn as needed to the gin still. Sufficient good-quality water is added to dilute the alcohol to about 125% proof. The juniper berries and other flavors required for a batch are placed in the gin head. High pressure steam is run through a coil in the still to cause distillation. The heads and tails are discarded, and the middle run, after dilution with distilled water in the blending tank to 80 or 90% proof, is drawn off to bottles.

Bath-tub Gin.—This term was applied during the prohibition era to so-called “synthetic gin” made by adding mixtures of essential oils or essences to a suitably diluted alcohol. Smootheners were sometimes added and the product was then ready for the market. Actually, while the term might have some bearing as applied to the questionably sanitary methods of small bootleggers, gin has largely been made in this way in all countries and at most times. Nor is there any very cogent reason why gin thus made
"synthetically" should be inferior *qua* gin to the distilled product. The question seems to be largely one of taste and we have previously stated that the taste for gin varies in different countries. Certainly, the probability is in favor of a synthetic gin being consistently uniform, batch after batch, and the balance of oils used as flavors can be so selected that any desired aroma is achieved.

**Applejack**

Applejack bears the same relation to cider that grape brandy bears to wine, but whereas fermented cider is more dealt in abroad than here; the reverse is true of applejack. It has been stated that applejack was first made in this country as early as 1698, and it is still a staple article of commerce.

Applejack is the product resulting from the distillation of fermented apple must. Hence, in general, the same considerations apply to the manufacture of applejack as to that of grape brandy, and the same processes are used. It should be noted in particular that the definition just stated differs from the popular impression of applejack as the unfrozen liquid removed from the core of a barrel of frozen cider. The product of this latter process would not only contain the alcohol of the cider, but also all its other dissolved substances and would be quite unpalatable. As far as any passable applejack is concerned, only that made by distillation need be considered, although it is possible that isolated farmers may in some few cases make their "hard liquor" in the more primitive fashion.

For the purpose of making applejack it is important that the cider be made from suitable apples both as regards variety and quality and that the fermentation be conducted in a manner to avoid as far as possible the formation of volatile acids especially acetic acid. The reader is referred to pp. 187-9 on Cider for further details regarding the fermentation operation. The next step after the fermentation and aging of the cider is the distillation of the brandy. Here particularly, the manner of procedure is similar to that in making grape brandy (*q.v.* pp. 141-2). Pot stills are generally preferred to continuous stills and two or three
ARRACK

distillations are used to secure the desired alcoholic strength coupled with the proper removal of foreshots and tailings, which contain respectively aldehydes and fusel oil. After distillation the spirit is aged in oak barrels. Uncharred barrels of well seasoned white oak are used, and those which have previously held wine or other spirits are preferred to new barrels.

It is claimed, that on account of the lower starch and protein content of an apple must as compared with a whiskey mash, applejack can be aged in a much shorter time than whiskey. Hence it is usually considered potable after as little as three to six months’ aging. It is, indeed, further claimed that apple brandy begins to lose its special character on aging in the wood for more than four to five years.

ARRACK

Arrack is prepared by distillation from toddy or a mixture of toddy with either fermented rice or rice and molasses mash. Toddy is palm wine which is obtained by fermenting the juice of the cocoanut palm. Arrack ranges from yellow to light brown in color. Its flavor and aroma resemble those of rum, if much molasses has been used in its preparation, but not to such an extent that the one could be substituted for the other without instant discovery. Normally arrack has a sourish aroma and taste which are claimed to derive from the toddy. The alcoholic content of arrack ranges from 70 to 80 per cent by volume.

It is used either as such or in the preparation of hot drinks (grog, punch), particularly in making Swedish Punch, and also for strengthening and improving the aroma of ginger liqueurs and bitters such as Angostura, Boonekamp, etc. It is also used in the preparation of sweetmeats.

Arrack is made in Siam, the Malay Archipelago, East India and Jamaica.

Manufacturing Process.—When rice or rice and molasses are used it is customary to employ only rice of the highest quality.

Germination of the grain is started by the usual moistening with water and spreading in heaps or layers. As soon as the kernels start to sprout the grain is crushed between rollers and
hot water is added until the temperature of the mash reaches the neighborhood of 140° F. Around this temperature the enzymes convert the starch to sugar. The wort is strained and cooled to approximately 70° F. Fermentation is started by adding either toddy or a toddy and molasses mixture according to the formula employed. The fermented wash is subjected to three or more distillations after fermentation is completed. The unusual number of distillations is required by the crude and inefficient stills employed.

Vodka

Genuine vodka is made from a mash of unmalted rye and either barley or rye malt. Potatoes and corn have been used as substitutes for rye in the cheaper grades. The alcoholic content of the better grades ranges from 40 to 60 per cent.

Schnapps and Kornbranntwein

These distilled liquors are consumed in considerable quantities in Germany, Holland and elsewhere on the continent of Europe.

Kornbranntwein is prepared from a mixed mash of malted and unmalted cereals, generally rye. Corn may also be used. Methods of manufacture are similar to whiskey processes.

Schnapps is diluted, rectified potato alcohol prepared by (1) heating a mash of potatoes under a pressure ranging from 30 to 60 pounds to achieve pastification of the starch; (2) converting the starch to sugar by mashing with malt; (3) fermenting according to standard methods; and (4) distilling so that the final product is well rectified.
CHAPTER XI

WINE

Definition.—The term wine is a very broad one. It includes, with proper qualifications, the product resulting from the fermentation, with or without the addition of sugar and other substances, of such diverse materials as dandelion blossoms, elderberries, etc. More particularly, however, it refers to the result of the alcoholic fermentation and other suitable treatments of grape juice. It is in this sense that we shall use the term here. The processes by which raw grapes are converted into wine include crushing, pressing, defecation, fermentation, fining, racking, fortification, etc. Historically, the preparation of wine is of immemorial age. As an industry it dates back for more than two millennia, which of course gives it rank among the oldest of human occupations.

Classification.—Even in the centuries before the Christian era, qualities of wine were distinguished and different grades were known and demanded by consumers. At the present time and for commercial use almost innumerable distinctions are made in the grades and qualities of wine, including naming by types, combined with geographical distinctions down to the name of a particular vineyard and further distinction by the year of the vintage. The brands and names recognized in commerce are to be reckoned by thousands.

A few citations are given to illustrate this point. Among the French red wines are many which are highly valued and of whose excellence there can be but one opinion. These include the red wines of Burgundy and especially those of Musigny, Richebourg, Romanee, Chambertin, Corton, Beaune des Hospices, Pommard, Volnay, Allos du Roy, and Clos Vougeot. The Clos Vougeot is one of the most highly prized of the products of the beauti-
ful Burgundian vineyards; its origin can be traced back to A.D. 1110 when the monks of Cipeaux received the vineyards from Hugues le Blanc, lord of Vergy, and cultivating with infinite care, succeeded in producing a wine which has maintained its reputation for centuries. The wines of Beaujolais such as Macon, Thomis, Fleuric, and Moulin-a-vent are also known, and the pride of the banks of the Rhone are l'Hermitage, Cote-Rotie, and Châteauneuf-de-Pape. But the French wines, however, which enjoy perhaps the greatest popularity in the land which produces them are the world-famous red wines of Bordeaux. Some of the principal varieties of these are Haut Brion, Château-Margaux, Château-Leoville, Château-Lafite, Château-Lagrange, Château-Larose, Château-Millet, Mouton-Rothschild, Château-Latour, Branaire, Montrose-Dolfus, Ducru-Beaucailloux, Clos d’Issan, St. Estephe, St. Emilion, and Medoc. Although the wines of Bordeaux have been famous for centuries, it was not until towards the end of the eighteenth century that they became really fashionable, a state of affairs which was largely brought about by the influence of Marshal de Richelieu, who introduced them to the notice of the Parisians.

There are a great many varieties of white wine, and perhaps the most famous of all is the Rhenish wine known as “Johannisberger.” This variety has a reputation which is world-wide, and is said to fetch the highest price among white wines. Enormous casks of Johannisberger which were casked and stored in their present position over three centuries ago are lying in the municipal wine cellars of the township of Bremen. This wine, known as “the Rose,” is as one might suppose, the subject of many legends, and is offered in hospitality to royalties and other persons of distinguished rank who partake in the festivities of the town; it is also graciously given to the sick. Other Rhenish wines of great repute are Rauenhalter, Liebfraumilch, Marcobrunner, Rudesheimer, Hoheheimer, Kottenlocher, Zeitlinger and Riesling.

The white wines of Burgundy are also highly appreciated and Montrachet is regarded by some as the king of white wines. Meursault-Goutte-d’Or, Chablis Moutonne, Pouilly-Tuisse are also excellent. Among the white wines of Bordeaux, Château
Yquem is considered the best, and Château-Myrat, Latour-Blanche, Clos St. Marc, and the wines of Sauterne, Barsac, and Graves also enjoy a high reputation.

There are many varieties of champagne, but some of the most famous are Pommery-Greno, St. Marceaux, G. H. Mumm, Moet et Chandon, Montebello, Heidsieck, Roederer, Mercier, Veuve Clicquot, and Lanson.

Most of these names correspond to real differences. Names taken from regions, such as Rhine wine or Sauterne, represent large differences in character easily distinguishable by taste and usually by chemical analysis. Names representing vineyards or vintage years represent differences of quality, which may be equally marked to the practiced taster, but are difficult to indicate by chemical means.

Names drawn from particular vineyards are properly considered proprietary and should not be used, nor the wines imitated elsewhere. Names drawn from localities or regions are of the same nature. They represent qualities due to special features of soil, climate, grape variety, and manufacturing methods which can not be identically duplicated in any other place. An exception should probably be made of certain names which, while originally derived from particular localities have come to represent, through long usage, characters due principally to methods of manufacture. Such names are Port, Sherry and Champagne.

The name Burgundy should properly be given only to wine made in Burgundy from Pinot grapes; the name Medoc only to wine made in Medoc from Cabernet and also to the three or four other varieties recognized there as capable of producing the wine to which the region owes its reputation.

There seems to be no sufficient reason, however, why a wine should not be called Port if it is made of suitable grapes in the recognized way and resembles those wines of the banks of the Douro, which first received this name. "Port," is no longer synonymous with "wine of Oporto." All the wines made in the region of Oporto are not port, nor does all port come from that region.

With these possible exceptions, locality names belong only to the wines produced in that locality. Not only is this fair to the
consumer, but it is sound policy in the selfish interest of the producer. Wines are produced most profitably by those localities which have an established reputation. They have a sure market whatever the abundance of crops in other localities. It should be the aim of each locality to obtain and maintain a reputation which will make it independent of general competition. This can be done only by marketing consistently good wines under the name of the locality.

The listing of wines in the manner indicated, while exceedingly important to the consumer of wines and especially to the connoisseur, is of little aid to the student or technician. Fortunately, it is possible to classify wines also in a more general manner on a basis of their gross composition, disregarding the fine distinctions made by the specialist. There are four dichotomous bases on which wines can be divided, namely:

1. Dry or sweet  
2. Fortified or unfortified  
3. Sparkling or still  
4. Red or white

These classes are defined as follows:

a. Dry wines are those in which practically all of the sugar has been converted by fermentation into alcohol. Usually they are of comparatively low alcoholic content (ca. 8-12%). This class includes such wines as Chablis, Riesling, Hock, Moselle, Claret, Burgundy, Gregnolino, and Chianti.

b. Sweet wines contain some unfermented sugar and have an alcoholic content usually between 13-15% by weight, all of which has been produced by fermentation. Auslese Rhine wine, Sauterne, and Tokay are wines of this class.

c. Unfortified wines are those whose alcoholic content is entirely derived from fermentation. All of the wines mentioned in classes a. and b. fall within this group.

d. Fortified wines derive some of their alcoholic content from fermentation and some from the addition of distilled spirits, usually grape brandy. They contain usually from 18-22% of alcohol. Madeira, malaga, muscatel, port and sherry are wines of this
class. Champagnes also fall into this group. Angelicas are sometimes considered to belong to this group although strictly speaking they are not wines at all, since they are made by adding sufficient grape brandy to fresh grape juice entirely to prevent any fermentation.

e. Still wines, which include most of those mentioned above, are those whose fermentation has been completed before bottling so that they contain only such proportion of the carbon-dioxide produced in the fermentation as can remain dissolved in the liquid in equilibrium with the air under the conditions of manipulation.

f. Sparkling wines are bottled before the fermentation has ceased so that they contain carbon-dioxide gas in solution at greater than atmospheric pressure. When they are served, the carbon-dioxide is liberated with effervescence. Their gas and alcoholic content vary according to the market for which they are intended. They may be dry or sweet, light or strong. Champagne, sparkling Burgundy, and Asti-Spumanti are examples of sparkling wines.

g. Red wines are those in which the skins, stems, etc., of the grapes are present during the fermentation so that the grape pigment is extracted and colors the fermented juice. This group includes the majority of wines as, for example, Claret, Burgundy, Port, Chianti, etc.

It should be particularly noted that the distinction between red wines and white is based on a difference in manufacturing process. This is of significance on the one hand because the variation in color of so-called red wines covers every possible tint from inky purple to pale pink and tan, and on the other hand because the inclusion of skins, stems etc., in the fermenting liquor leads to somewhat different composition of the wine and requires different handling from white wines.

h. White wines are produced by fermentation of the grape juice only, with removal of the marc (skins, stems, etc.) before the fermentation has proceeded to a point when the pigment becomes soluble. Riesling, sauterne, and champagne may be cited as examples.
It will be seen that by combination of the classes just given, sixteen possible categories are obtained into which wines may be classified. For instance, claret is a dry, unfortified, still, red wine. However, champagne may be a fortified, sparkling, white, either sweet or dry wine and many other wines can be placed in more than one category. Despite this ambiguity, these categories are sufficient for scientific purposes, being based partly on the nature of the raw material, partly on the composition of the wine and partly on the methods of manufacture.

A further subdivision of wines may be made within any of the groups mentioned, on the basis of quality, into three grades: fine, ordinary, and blending wines. A fine wine is one, all the components of which are in proper and harmonious proportion, and which has sufficient quality to repay aging and bottling. These constitute, in most regions, only a small part of the product. They are, however, the ideal toward which the efforts of every wine-maker tend. Ordinary wines are those which are sufficiently harmonious in their composition for direct consumption, but which exhibit no great delicacy of flavor or bouquet. These are usually destined for bulk shipments and cheap markets. Blending wines are of various degrees of quality and character, but agree in having a deficiency or excess of some one or more essential components. There are blending wines with an excess of alcohol, or extract, or color which make them unsuitable for direct consumption. They serve, by blending, to correct other wines which are deficient in these components. Where the wine handlers have perfected their business, the bulk of wines are used for blending, for it is only the exceptional wines which cannot be improved by additions to correct their deficiencies and faults.

Functions of Wine.—The experience of many centuries has taught mankind that wines, when used in proper combination with foods, not only enhance the flavors of the food and the enjoyment in partaking of them, but aid in the digestion. There follows an abridged tabulation of the principal classes of wine together with the foods they should accompany:

*Dry white wines*
- Oysters, fish, fowl, turkey, vegetarian dinners, omelettes, etc.
Dry red wines
Roast meats such as beef, pork, lamb, steaks and chops, duck, goose, turkey, pheasant, venison, etc.; Italian dishes such as spaghetti, ravioli, macaroni, etc.

Sparkling wines
These are the proper accompaniment of the end of the meal, sweets and cheese.

Fortified wines
Sherry is preferred to any cocktail by almost all peoples but the American. It is also the proper wine to serve with soups and with hors d’oeuvre. Port and other heavy wines like Malaga, etc., are sipping rather than drinking wines, and should be used with circumspection during the evening, when the appetite no longer clamors and the excellencies of the wine can be savored slowly.

In fine cooking, wines play an important part which largely forms the basis of the reputation of the French cuisine.

Manufacture of Wine

Introductory.—The manufacture of wine is, in principle, a matter of the greatest simplicity. The grapes are crushed, the juice fermented, the sludge of exhausted yeast and precipitated matter is removed by decantation, and one has wine. Unfortunately, there is an equal probability that if no more than the above is done, the product will be vinegar or something equally unpotable. Much more must be done if the wine is to be of a high quality. The ultimate in quality, of course, the wines that elderly connoisseurs sip with tears of thankfulness, are dependent not only on full and thorough care in their processing but also on a combination of favorable weather, soil, etc. in a given year in a given locality. These accidental factors are beyond human control. The control of the stated steps in production of wine is, however, readily feasible and will be the subject of the immediately following pages.

Components.—The fine points of wine making are necessitated by the original composition of the fermenting mass and the nature of changes which may occur during the fermentation and after-processes. The must (fresh pressed juice) contains
sugar, organic acids, tannin, flavoring substances, proteins, mineral salts, and pectin and mucilaginous substances which it derives from the grapes. It also contains a large variety of yeasts, bacteria, and fungi, some of which are favorable and some the reverse. An average composition is indicated in the following Table IX reported by Koenig:

**Table IX.—Analysis of Wine Musts**

<table>
<thead>
<tr>
<th></th>
<th>Sp. gr.</th>
<th>Water %</th>
<th>Nitrogenous matter %</th>
<th>Sugar %</th>
<th>Acid %</th>
<th>Other non-nitrogenous matter %</th>
<th>Ash %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimum...</td>
<td>1.0690</td>
<td>51.53</td>
<td>0.11</td>
<td>12.89</td>
<td>0.20</td>
<td>1.68</td>
<td>0.20</td>
</tr>
<tr>
<td>Maximum...</td>
<td>1.2075</td>
<td>82.10</td>
<td>0.57</td>
<td>35.45</td>
<td>1.18</td>
<td>11.62</td>
<td>0.63</td>
</tr>
<tr>
<td>Average...</td>
<td>1.1024</td>
<td>74.49</td>
<td>0.28</td>
<td>19.71</td>
<td>0.64</td>
<td>4.48</td>
<td>0.40</td>
</tr>
</tbody>
</table>

These components and their changes are very largely interrelated. When the sugar content is high enough the activity of the first fermentation prevents much action by harmful organisms. Later, enough alcohol has been produced to prevent the growth of these. A proper sugar content lies between 18 and 28%.

Organic acids, especially tartaric, serve to produce sound and healthy wine in a number of ways. Sufficient acidity encourages sound fermentation and inhibits the growth of the disease bacteria. Sufficient acid ensures a full tasting wine which will store well, while insufficient acid means a flat taste and short life. Acid also ensures a better extraction of color from the skins.

Tannin, which is derived by extraction from the skins, seeds and stems of the grape is an essential constituent of the wine. It serves to confer disease resistance on the wine, aids remarkably in the clarification and produces a more brilliant color. On the other hand, an excess of tannin confers an astringence on the wine which delays its final maturity, although in the end the wine is more mellow for it.

The flavoring substances present in the raw grapes undergo
many changes during the life of the wine. To some extent they control the flavor of the end product. However, the extent of the changes has never been followed completely by chemical research so that little can be said on this topic. The characteristic bouquet of the finished wine is only slightly due to methyl-anthranilate, which has the distinguishing character of fresh grapes. Various aliphatic ethyl esters are formed as the wine lives, and these, the action of special varieties of wine yeast (S. Ellipsoideus), and even of frost (as in Reislings) each contribute their share to the final celestial bouquet of good wine.

The relation of the constituents of the raw must to the finished wine is shown in Figures 35, 35a.

Red Wines.—The production of wine falls naturally into two broad divisions, red and white wines respectively. The production of champagne and of other fortified wines may follow in
RAW GRAPE JUICE

Sugar
Organic Acids
Tannin
Flavoring substances
Protein
Mineral Salts
Pectins
Favorable Yeasts
Unfavorable Organisms

Partly Consumed by Yeast. Partly precipitated as Potassium Bitartrate. Partly give zest to finished wine.
Helps form precipitate of unwanted matter. Partly gives zest to finished wine.
Changes unknown in detail
Serves as yeast food
Partly precipitate during fermentation and ageing
Precipitate during fermentation

Various acids which esterify yielding flavors
Residue to finished wine

To Atmosphere
Carbon-dioxide

FINISHED WINE

Fig. 35a.